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## The Problem of the Gas Engine.

BY HERBERT L. TOWLE.

As the large gas engine must compete with the steam engine, so must the small gas engine compete with the electric motor; and in both cases its chief handicap is its unreliability. Moreover, while we know that most gas engines might be made more reliable than they are, it is nevertheless true that this defect is in a sense inherent, because the gas engine is primarily a chemical, not a mechanical apparatus.

That is to say, it is designed primarily to effect the combustion of its fuel under conditions both disadvantageous and intricate; and only after that combustion has been accomplished is the engine a mechanical agent for converting the heat energy into work. If a steam engine stops it is because something is broken or bent, or because an eccentric has slipped or a valve leaks; and the identity of the part is seldom long in doubt. If even an electric motor, which is generally a profound mystery to the layman, gets out of order, it betrays the nature of the trouble by local heating, by sparking, by failure to magnetize, or the like; all of which signs have their meaning to the electrician. Moreover, a steam engine is never supposed to be used without a competent man to look after it; and the electric motor, commercially speaking, does not get out of order. If properly oiled, kept clean and not overloaded, it may be hid away in a corner and left to run indefinitely with no further care than to renew the brushes. If it gives out, through lack of ordinary attention, a moderate outlay for truing up the commutator or repairing an open coil will usually make it all right again.

But not only is the gas engine completely out of the electric motor's class in this latter regard, requiring as it does as much care as a steam engine for its mechanical parts, but it may and usually does balk when no cause whatever is visible, and when, mechanically speaking, it is in perfect order; this happening from some obscure disturbance of the delicate equilibrium of conditions on which combustion depends. This is not surprising when we reflect that the cylinder is virtually a very small firebox with water cooled walls, that we have neither a bed of incandescent fuel, brick arch nor length of uptake, and that our gases are lighted and must burn themselves out from two to eight or ten times a second. The one thing, indeed, that renders these results possible is the compression which drives the vibrating molecules of gas and oxygen close together and preheats them before the spark or hot tube gives the quick additional impulse to their velocity, which makes them meet and unite.

From these facts, well known to designers, two conclusions follow. The first is that the most immediate need of the gas engine is neither higher economy (though this is not to be disregarded), for it is already more economical than its competitors; nor lower price, for it is on sufficiently even terms in that respect at present; nor better mechanical design, for this is a matter only of experience and judgment on the part of the designer; and in respect of lubrication, balancing, valve gears and the like, the best engines of to-day leave little to be desired; nor is it even better regulation, for regulation as steady as desired can be obtained without unreasonable sacrifice of efficiency by throttling the charge or dividing the power; but what the gas engine requires to make it a serious factor in the commercial world is that the elements of uncertainty connected with its chemical operation be reduced to the utmost minimum or abolished altogether. Desirable in any case, this becomes a necessity when it is put in competition with its less fickle rivals. The second conclusion is that, to abolish this uncertainty, the conditions affecting combustion must be subjected to positive and automatic mechanical control, so that it shall be impossible for them to vary without actual and sensible derangement of working parts. In proportion as this is accomplished, and only in proportion, does mechanical certainty take the place of conjecture, and reliability become a question merely of the number, intricacy and durability of the several parts. To achieve this then may at present be considered the chief problem of the gas engine.

The purpose of the present article is not to solve this problem or to claim that it is easy of solution—for the reverse is true—but only to analyze the several factors on which ignition and combustion depend, and to examine the principal methods thus far employed to control them mechanically.

A charge in condition to burn rapidly is also in condition to ignite readily, and the converse is likewise true unless the charge be "stratified" or otherwise irregularly composed. We may begin, however, by saying that ease of ignition depends on four things: (1) The proportions of air and gas in that portion of the mixture adjacent to the igniter, such proportions depending on the nature and richness of the gas; (2) the degree of compression; (3) the temperature of the mixture or of that portion of it; and (4) the form and energy of the igniting agent itself. All of these factors are essential and interdependent, so that a deficiency in any of them must be made up by a corresponding betterment in one or more of the others. When the charge has been ignited the rapidity of its combustion depends on (a) the proportion of gas to air; (b) the completeness of its diffusion or the homogeneity of the charge, and (c) the compression. In addition, the temperature of the charge, the heat and relative extent of the walls, and especially the energy of the spark or hot tube, exert an influence which is more or less important though not of the highest order. The requirement, then, is to devise means by which a proper equilibrium of the above conditions, once found, shall be maintained practically constant, or subject only to intentional and rigidly limited change for the purpose of governing the engine.

Given the fuel, the efficiency of an engine will depend largely on the rate of combustion, which should be moderate for small cylinders with jacketed combustion chambers,* and as rapid as possible for large cylinders and those with unjacketed combustion chambers. On the ignition, however, depends whether the engine will run at all, and therefore the ignition is the first thing to be looked after.

Taking the second item first, viz., the compression, there is little to vary this when the engine is running under full load and the governor is not acting. Aside from obstruction to the air supply, it can be changed only by leakage in the

*See article on "Small Gas Engine Cylinders," by the writer, in the "American Machinist" for July 28, 1898.

piston rings or valves or by a large variation in the flow of jacket water, for none of which should there be any excuse. If the governor be of the throttling type any change in compression is proportioned to the load, and need affect practically no other factor save to necessitate a heavier spark. The chief difficulty with it is in starting, when the charge will leak away in small cylinders and is voluntarily reduced in large ones. On this account, and also because of the cold walls and the uncertain quality of the mixture, it takes a heavier spark to fire the first charge than is needed to keep the engine running; and it would be well if every electrically igniting engine were equipped with extra cells of battery for this single purpose.

The temperature of the (compressed) charge may vary from the compression being varied, or from cooling of the walls during missed explosions. The writer's experience with hit-and-miss governed engines, which held the exhaust valve open during mischarges, has been that the first explosion after one or more misses was much weaker than the normal, owing, presumably, to this cooling of the walls and head. The published testimony on this point is conflicting, however; and it appears that if the governor act only on the fuel supply and permit a "scavengering charge" of cold air to enter the cylinder during mischarges, the cooling effect is fully compensated by the extra purity of the next charge.

As to the igniter, our choice in the usual types of engine lies between the hot tube and the electric spark, with opinion about evenly divided between them. If the latter be used it may be a "wipe spark" with steel rubbing points, or a "lift spark" with contacts tipped with platinum. It may fail through wear, insufficient battery strength, bad connections, incrusted contact points, defective insulation, through breaking contact too sluggishly, or through losing the correct timing by wear or otherwise. The lift sparker is less liable to the last named fault, and the wipe sparker to that next preceding. A quick acting lift sparker with all springs outside the cylinder is probably the most reliable form. A very bad arrangement is to have contact broken by the lift of a cam or the rising of the piston, as then the points separate so slowly when starting as to produce no active spark at all. It is not uncommon to see a gas engine taking its igniting current from an incandescent circuit with one or two lamps in series, but this is not to be recommended, as the high voltage tends to break down the insulation. If anything more than a half dozen cells of "Samson" battery is required it is because the compression is too low or the mixture is imperfect, and the trouble should be remedied at its source. At its best, however, the electric spark cannot be made absolutely reliable: and with all its drawbacks it is the distinctive advantage of the hot tube, if made of porcelain or resisting alloy and properly hooded, that there is literally nothing about it that can get out of order.

It was said above that one factor in ignition is the proportion of gas to air immediately about the igniter. The only final way to prevent variation here, however, is to make the mixture alike throughout, and then compress it enough to compel ignition. There are other reasons for this, and it is quite certain that the importance of homogeneity is seldom recognized at its full value. In the ideal case, where every molecule of combustible has its quota of oxygen immediately at hand, and no more, combustion will be simultaneous with inflammation, and its duration will be according to the rate of flame propagation, which, given constant mixture and jacket flow, may be rigidly defined by the compression and time of ignition. In practice every degree of neglect of this precaution may be found, even to the injecting of liquid gasoline into the compression space. The natural result is that the molecules of fuel and oxygen must go a-hunting for each other, combustion is indefinitely prolonged, and abnormally early ignition—a great nuisance in starting—is necessary, and, in general, an element of uncertainty is introduced as annoying as it is needless. It is true that a rapid combustion is not always desired, but the place to control this is in the compression and ignition time, which are positive, and not in the mixture, where there are a dozen influences to affect it. There is no doubt that many cases of back explosions, which the makers seek to prevent by not mingling the charge till the moment of admission, are due to this precise thing. As to "stratification," it is objectionable in small cylinders for a reason somewhat similar, in that the weakest strata are the last to receive the flame, when expansion is probably well under way. In large and slow running engines, using dilute mixtures, it should work better.

To this last paragraph a certain exception is to be made in the case of those oil engines which vaporize their fuel in a red hot combustion chamber, into which the air is afterward compressed. These have the advantage of a greatly extended igniting surface, which induces a very rapid inflammation, and this may be taken as offsetting the somewhat tardy completion of the mingling and combustion. The Hornsby-Akroyd is the best known of these, and in this engine the mingling of air and vapor during the compression stroke is assisted by the vortical effect of the former's passage through the narrow neck of the "retort." Engines of this type inject the oil, so much per stroke, by a small plunger pump, and have the advantage of a substantially definite fuel supply.

This matter of fuel supply, or of preserving the correct proportions of the mixture under all vicissitudes of service, is indeed the most difficult part of the gas engine problem, and it is within bounds to say that an adequate solution of it for the other types would abolish two-thirds of the troubles at present connected with the running of these engines.

Taking first those using gas, we see that one component of the mixture is supplied under pressure from the gas mains, while the other—the air—is not. The volume of the latter, therefore, is limited by the stroke of the piston, or by the governor, if this be of the throttling type, while the gas is under no such restriction, but tends to flow in as long as the valves are open. It does not in fact do this when the engine is under way, because the suction quickly reduces the pressure within the gas bag to that of the air outside, and thereafter collapses the bag without changing the pressure; but when starting it is absolutely necessary to throttle the gas supply to prevent "flooding" the mixture. As the amount of throttling needed, with a given supply pipe, etc., depends wholly on the gas pressure and the rate at which the fly-wheel is turned, it becomes a matter of experiment to get it right, and it may even vary for different hours of the same day, owing to the daily fluctuations in the mains, which are often so marked as seriously to disturb the running of the engine when under way, and which it requires an automatic pressure regulator to overcome. To make the gas supply positive the most obvious device would be a separate gas pump with adjustable stroke, but there are complications in the way of using this in connection with a throttling governor, and, so far as I know, only one engine, the Mietz & Weiss, uses it at all. A helpful makeshift is to put an index on the gas cock, by which the attendant can set it to a defined point, learned by experience, when starting. This is by no means a perfect solution, but it is far better than nothing, and it is surprising that so many engines are allowed to go on the market unprovided with this simple device.

When gasoline is the fuel, a common method is to admit it to the suction pipe or mixing chamber through a mechanically opened needle valve. The difficulty here is similar to that with gas, and is only half solved by drawing the gasoline at constant pressure from an overflow cup. It cannot be used at all with a throttling governor. Another arrangement is to attach the gasoline valve to a suction lifted air valve at the mixing chamber inlet, but this method is correct only with hit-and-miss governing and at constant speed, and is objectionable from its lack of positiveness and because it reduces the volume of the charge. The above and similar devices are not properly carburetters, as they are intended to admit only the needed quantity of gaso-

line, and to mix it with the air at one operation. They work well at uniform speed, and by reason of their simplicity they are common on boat engines, but they all give trouble in starting and are wholly worthless for motor vehicles.

Another class of apparatus, however, aims at producing a saturated mixture, whose density may be kept constant, and then diluting this to the point of inflammability, a process which distinguishes the carburetter from the simple mixer or vaporizer. This may be done, where a pump is used, by spraying an excess of gasoline into the mixing chamber, and piping the unvaporized surplus back to the tank. When no pump is used the air may be drawn past saturated sponges or folds of cloth or sucked down and through the liquid. The last named form has the defect of requiring an initial vacuum in the mixing chamber equal to the number of inches of gasoline down which the air must be drawn, and hence necessitates readjustment of the dilution inlet for changes in speed and for starting; but with this exception the carburetter eliminates the question of pressure from the fuel supply, and, in theory at least, secures a mixture at once uniform and homogeneous, unaffected by the speed of the engine or the form or action of the governor.

Unfortunately, however, while escaping the influence of pressure the carburetter introduces that of temperature. Gasoline, like any other liquid, absorbs heat on vaporizing, and unless this heat is supplied from some source to the carburetter or the air drawn through it, the former becomes very cold or even "freezes up." We thus have a respectable range of possible temperatures, at each of which the saturation point of the mixture will be different, and at each of which the dilution inlet must be readjusted. If the engine is connected with a gasoline "vapor gas" producer, an automatic regulator will take care of the density, but when the engine makes its own vapor the usual practice is to draw the air through an air jacket around the exhaust pipe, so that, starting with the engine cold and the carburetter at atmospheric temperature, the tendencies to heat and cold will balance. This, however, while it prevents freezing up, can hardly be considered the last word of science, and yet it is the best thing to be had on the ordinary gasoline engine to-day. Some builders, using a hit-and-miss governor, attempt to get rid of the whole matter by injecting the gasoline directly into the cylinder from a pump, but this sacrifices all the advantages of homogencity, and in small sizes involves some risk from leaky stuffing and uncertain check valves.

Indeed I believe there is but one internal combustion engine to-day which disposes at a stroke of the whole problem of proportion, commingling and ignition by doing away with the causes of trouble. This, of course, is the Diesel, which compresses its gas and air separately to a point that compels spontaneous ignition, and then injects the one into the other in quantities varied at will. When using oil it sprays it into the cylinder by a jet of compressed air, and in either case the fuel burns as fast as it enters, and the question of proportion does not enter, the air being always in excess. Nothing but a leak or other positive derangement can affect its action, and this novel motor, besides making the most striking advance in fuel economy of recent years, is entitled to the credit of being the only gas engine that can be classed with the steam engine in point of reliability. The success of its American owners in simplifying its design to meet American demands will be awaited with general interest.

Nevertheless, even if the ordinary types of gas engine cannot always abolish the sources of trouble, they can do much to circumscribe them, and in attempting this the fundamental principle is to be remembered that in the gas engine at least reliability does not necessarily attend mechanical simplicity. If a factor in its operation is elusive it should be got rid of if possible in favor of a less devious substitute. Of such a kind are the substitution of poppet for slide valves, of electric and hot tube for flame ignition, and of spontaneous ignition for these. But such inventions come but rarely, and if no substitute be found for the factor in question the next best thing is to add mechanism to control it. In particular it is difficult to see how the mixture proportions are to be regulated, save in engines of the Hornsby-Akroyd class, without important additional mechanism, but it is equally difficult to see how the gas engine is to oust the steam engine without it. There is a class of purchasers, the annual primer class in things mechanical, which is of opinion that the gas engine should be as cheap to build as it is to run, and there is likewise a class of builders which devotes to encouraging this delusion an amount of ingenuity and effort which might much better be spent in improving their product. Happily the future of the gas engine is not committed to either of these. What it will be in the next century depends on those men who, with thorough grasp of its practical needs, and bringing trained minds and wide knowledge to the task, have resolved that they will make it notable, not merely in the laboratories, but in the forefront of industrial progress.

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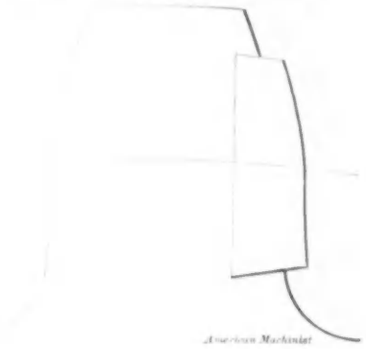
## Faced Gear Teeth.

The latest new thing in the way of toothed gearing is shown by the accompanying engravings, and consists of forming a taper and dovetailed groove in the side of each tooth, into which is driven a suitably formed piece of rawhide, fiber or any other substance that may be preferred.

Experience with gears made in this way shows them to be more durable than wooden toothed or cogged wheels, because the fiber or rawhide is tougher and wears better. In fact, the rate of wear for fiber was in one case about one-fifth that of wood in the same place and doing the same work, and as the fiber strips make no trouble by shrinking or working loose the gear requires much less attention. Then when strips are to be removed it is a simple matter to drive out a worn strip and drive in a new one, and since all strips for a given wheel are alike, no fitting is required. These gears are being made by the Gleason Tool Company, Rochester, N. Y.



FACED GEAR TEETH.

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An English correspondent in the course of a private letter remarks: "It will be some little time yet before we can properly gage the stimulating effects of American enterprise over here, but it has assuredly already done much good. The English had got too much in the habit of fancying themselves supreme in manufacturing. A good tonic in the shape of foreign competition is very salutary. I quite agree with you that when you can export machinery at a profit it is childish to irritate other countries by heavily taxing their exports in that line."

## APPLICANT. Date.....

Name..... Age.....

Address.....

Real Estate Owner. Yes. No.

Location of Real Estate.....

.....

Description of Real Estate.....

.....

Married. Single.

Trade.....

REFERENCES:

| NAME. | ADDRESS. |
|---|---|
| | |
| | |
| | |

Why did you leave last position.....

.....

## EMPLOYEE. No.....

WAGES PER HOUR.

| DATE. | RATE. | DATE. | RATE. | DATE. | RATE. |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## EX-EMPLOYEE.

Date of Discharge.....

Reason.....

.....

Remarks.....

.....

.....

| DATE. | IN EMPLOY OF. |
|---|---|
| | |
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FOR FURTHER INFORMATION SEE INSIDE.

## A System for Keeping Records of Applicants for Work, Employees and ex-Employees.

In large cities especially we think shop proprietors generally are and have good reason to be dissatisfied with their own methods of handling the matter of engaging help, keeping a record of applicants, employees, ex-employees, etc. It is quite a common thing to see gathered about the doors of a city manufacturing plant every morning a crowd of men looking for employment. If it happens that men are wanted on that particular morning the required number are selected from the crowd and employed, some of them perhaps turning out to be satisfactory and others entirely unfitted for the work.

While this method does passably well for laborers or entirely unskilled men, it is about the worst possible for skilled mechanics. It never secures the best of them except by mere chance, since the best man among the applicants during any given week or month may be missed, because on the particular day on which he called no men were needed, and the plan, if it may be called a plan, makes no provision for getting a man except from among the personal applicants on the day the man is wanted. Besides, the best men will not apply for places in that way. They very properly object to standing outside like beggars with a promiscuous crowd of chunkers and roustabouts waiting for some supercilious clerk to tell them to go away.

Mr. H. M. Lane (of the Lane & Bodley Company, Cincinnati) undertook to solve the problem involved in this matter, and after investigating the plan used by the National Cash Register Company, which we described last year, adopted the system of which the herewith illustrated envelope forms the most important part.

These envelopes, which are made of heavy manilla paper, 4½x10½ inches, are placed in a drawer standing on end, this drawer being about 11 inches deep and divided longitudinally into three parts slightly wider than the envelope. The envelopes are then set up on end in these compartments, and in the first, or left hand, of these compartments are those which relate to applicants only and having only the upper portion of the blanks filled out.

They are arranged in the compartment the same as a card index and separated by suitable index cards into trades. That is to say, machinists are all together and are indicated by a card projecting slightly above the envelopes and bearing the word "Machinists," and similarly for molders, patternmakers, draftsmen, etc.

Whatever in the way of letters of recommendation, cards of persons referred to, or other things in connection with any applicant that it is desired to keep, is put into the envelope, and when a man of any kind is wanted the envelopes de-

voted to the kind of man desired are consulted and a selection made, the man to be, however, of course further investigated if found advisable.

In the middle division of the drawer are those envelopes which relate to employees, and which accordingly have both the upper and the middle sections of the blank form filled out. These are arranged by departments, *i. e.*, those that relate to the pattern shop are together, and so on for each department, the envelopes in any subdivision being of course arranged alphabetically.

In the third or right-hand division of the drawer are the envelopes which relate to ex-employees, and have all the blanks filled out.

The first or "Applicant's" blank is filled out by the applicant himself preferably, and it will of course be understood that the envelopes progress from one division of the drawer to another in accordance with the progress of the individuals to whom they pertain. The blanks explain themselves, and it will be seen that these envelopes with the entries upon their faces, with what they may contain and by their positions in the drawer, give all the information needed regarding any workman who has either applied for work, has been employed or has left the establishment for any reason.

Near the drawer in which these envelopes are kept is a small blackboard on which, when men are wanted for any department, that fact is written, the board not being visible to applicants.

Mr. Lane declares himself very well satisfied with the practical working of this system, and it seems to meet all the requirements of the case.

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## Some Recent Experience in Casting Wrought Iron.

BY C. VICKERS.

A few years ago most iron founders would have been considerably surprised to learn that it was possible to make castings of wrought iron, and even now there may be some who are ignorant of the possibilities in that direction, while outside of the foundry business very few people are aware of the fact. An instance of this came to my knowledge a short time ago. A certain firm with whom I was acquainted, who used large numbers of light forgings in their business, were behind with their orders, owing largely to the limited capacity of their blacksmith shop, which capacity they had then no time to increase. I suggested that if they used castings for the more crooked pieces they could weld them on to the plainer portions as required and effect a considerable saving in time and perhaps in money. At first they ridiculed the idea, thinking that I was not in earnest, but after a while they considered the matter and told me that they had already tried steel castings and found them unweldable. I finally, however, persuaded them to rig up a few patterns, and send a trial order to a firm making such castings, which they did, and in due time the castings arrived, and as castings they were pronounced satisfactory, but they had very little faith in their weldable properties. No time was lost in putting them to the test, however, and they were all much astonished to find that the castings did weld, and that readily, requiring no different treatment from that given to any piece of rolled wrought iron.

The size of weldable castings is limited according to the facilities which the shop may possess to melt and handle the metal. In my experience I have never known the metal successfully melted otherwise than in crucibles, and then on a commercial basis in quantities of about 140 pounds to each crucible. Although we succeeded in melting larger quantities in larger crucibles, we did not have the success that we had with the smaller ones, because the large pots had to stay in the furnace so much longer that it cost considerably more to melt than if we had melted the same quantity in the smaller pots.

We also tried melting in bulk, but with indifferent success. Abandoning the attempts, therefore, we confined ourselves to the crucible process. When we began we only got about 180 pounds of metal out of each pot, as that was the amount of cold metal we could pack into the pots. We always packed the pots cold, carefully arranging the larger pieces of metal with a certain amount of runners, gates, etc., and filling the spaces between with boiler punchings. But experience is a great teacher, and we found that we could fill the pots by charging additional metal when the first charge had settled down into a pasty condition, so that after that we brought out each pot just as full as was consistent with safe handling. Another thing which we improved upon was the melting capacity of our furnaces. We used the Nobel furnace, with oil as fuel, and our earlier ones were four-pot furnaces only, two pots in the first and two in the second chamber. We experimented with a six-pot furnace, but found it unsatisfactory, as the middle pot melted faster than the others, and, as we could not remove it until all were ready, it often broke in the furnace, becoming so softened by the prolonged exposure to the heat that it collapsed when gripped by the tongs. After we understood how to regulate the flame, however, we found that these furnaces were the most economical, and now use them exclusively, having taken out over a ton of metal from one such furnace in a day's run of from twelve to fourteen hours. The furnace was lighted at 2 in the morning, the first heat of three pots being ready at 7. By manipulating the flame we ultimately succeeded in getting the six pots ready at the same time, melting in the second as well as the first chamber, so that we could pour a 500 pound casting from one furnace.

We also in those earlier days had difficulty in running out work. On such comparatively heavy castings as shoes for well-borers, although we "chop-gated" them, it was no uncommon thing to see them only partially run up. These castings are merely rings or bushings, and vary in diameter from 4 inches up. The 4-inch are about 1¼ inch in thickness at the top and ⅜ at the bottom. We afterward learned to run them entirely from the bottom, and now never have any trouble, the secret being that we learned to use our metal hotter. The condition of the metal, when in the furnace is ascertained by introducing a quarter-inch iron rod into the crucible through the hole in the cover of the furnace. When the rod is withdrawn, if the metal is sufficiently hot, it will not adhere thereto, the rod being merely coated with a thin film of slag.

A large percentage of our work consisted of orders on patterns originally designed for malleable iron, the owners of which found that the wrought iron product was better adapted to their needs than malleable. Some of these castings were only 1-16 inch in thickness, of intricate shape and cored out. We found these patterns, gated as they were for malleable, admirably adapted for mitis. The shrinkers kept the gates solid and fed the castings. We found it prudent, though, to enlarge the gate to about twice its original width. We made them in greensand, using our facing as dry as possible, and instead of water we used kerosene oil as the medium for wetting the sand around the patterns before drawing. This is very important on greensand molding for this peculiar metal, as its intense heat generates steam so rapidly when it strikes a wet spot that the metal is thrown out of the mold with the force of an explosion; even a few drops of water dropped down a sprue will often destroy the mold. Oil, on the contrary, can be used freely without the slightest inconvenience. We used iron flasks made unusually strong. The sprue or runner was placed, as is usual in snap flasks, in the center of the gate, and, instead of reaming out the head, we merely withdrew the gate stick, and after the mold was finished and closed, we bedded thereon a dry sand-head. These were made out of facing or core sand in a regular core box, and were about 4 inches in diameter by 4 inches in hight, the hole in the center being, of course, bell-shaped, the heads being merely dry sand funnels. Our weights were made with a hole in the center large enough to admit the head, and when pouring we arranged our molds side by side in rows. The pourer and his helper were on opposite sides of the row, holding the shank diag-

onally, the pot being directly over the center of the molds. Another assistant followed, and as the molds were filled covered the heads with sand in order to shield the helper from the heat. As soon as the heads were set, which was almost immediately, they were broken off, thus making it easier to pack the sprues when filling the pot. After pouring about six molds of the light work, the rest of the metal is emptied into heavier castings, as it has then become too cool for the light ones.

There is a general impression with molders that molds for steel cannot be rammed too hard. My experience, however, in greensand taught me that they should be rammed as soft as possible, otherwise the metal will not lie quietly and blowholes will be the result.

While the greensand method proved satisfactory on the class of work we have just considered, we found that on general jobbing work it was best to dry the molds, as the castings were much finer in appearance. In arranging the small patterns of this character we placed them as near to the sprue as possible, making it also large enough to feed the castings. Before setting the molds aside we tried on the copes, to press back to place such portions of sand as had been loosened in drawing the patterns. We found this quite an economy, as otherwise the loosened pieces of sand often escape observation, and when the molds are dry they crush and break away in closing, forming an unsightly joint. In order to give the castings a better surface, we sprayed the molds with silica flour facing mixed with molasses water. The brass molders' spray can we found a very handy tool for this purpose.

We also practiced "skin-drying" to a considerable extent on light floor work, and found it very useful, not only on such work as was liable to crack if cast in dry sand, but also on large castings of a simple nature, which were made rapidly, as it obviated the necessity of keeping a large stock of flasks on hand, besides enabling the same to be made of wood instead of iron. We made quantities of racks, about 3 feet in length, and as we had only two patterns for them we made our flasks to suit, long and narrow. The castings were run separately, gated at the end, and each mold when poured was given a considerable inclination. As the molds were finished they were lightly sprayed with the silica wash, then dried with the gasolene flash and left open until a few minutes before pouring, when a little more gasoline was burnt off, after which they were closed, clamped and poured. Another type of casting was a rectangular frame about 3 feet by 2½, 2 inches in width and ⅝ thick. This we gated at one corner, using a broad, rather thin gate, and we inclined the mold so that the metal would have a down hill run all around. We considered it a remarkable achievement to run such a casting as this from one pot in this metal, and when it is considered that the pots always come out of the furnace one after the other, unless there is a heavy piece to be poured, it was quite a convenience to be able to do with one pot. The most important factor in the pouring is the inclining of the mold. On the level it would never run, as, if more than one gate is used, the contraction will certainly break the casting.

For skin-drying work of a heavier character we used charcoal pans, as the molds are then dried more thoroughly than with gasoline.

Chicago, Ill.

▲ ▲ ▲

## Tool Building in Cincinnati and Vicinity.

A tour among the shops of Cincinnati and vicinity shows them to be phenomenally busy at present, and we believe every tool shop in the city has either recently moved into new and larger shops, is now doing so or soon will do so.

Many of them are working evenings a part or the whole force, and in some places a portion of the tools are kept going by two gangs of men.

The new shops are in every case a very great improvement upon old ones, and proprietors and men are well pleased with the change, especially where it has taken them out of the crowded and grimy manufacturing district, near the river, to the suburbs, where the air is clear and the general surroundings much more cheerful.

A very large proportion of the work in nearly all the shops continues to be for foreign shipment and the rush to fill orders and the demand for men have led to some advance in wages. Though prices of standard tools are more stiffly maintained, there has been no general advance in quotations, but it is expected that there will be such an advance when stocks now in the hands of dealers and others are more completely exhausted. The already very large Niles Tool Works are being enlarged by the erection of an additional building for manufacturing some smaller lines of tools, and an interesting feature of their business is in the size of some of the tools now being built for foreign countries. They have recently shipped two 12-foot planers to the Vickers Sons & Maxim establishment at Sheffield, for planing armor plate. Some particulars of these tools we expect to give in a later issue. They are also building some uncommonly large and heavy drilling, boring and milling machines for foreign shipment. On the floor at the present time is a 70-inch lathe for the Midvale Steel Works. This will take 40 feet between centers and is 56 feet long over all. It is intended for the heaviest turning and to bore holes up to 18 inches diameter out of the solid in steel ingots. A maximum pull of 40,000 pounds is provided for at the pitch line of the face plate driving gear, which is 68 inches diameter. The carriage is fed by a very heavy lead screw in the center of the bed, and it is designed to be able to exert a pressure of 150,000 pounds upon a boring bar clamped in a bracket attached to the carriage. The feed for this will be about 1-32 inch per revolution.

Another lathe for the same people is a 52-inch, designed more especially for boring and having a "boring bench" with bar capable of boring a hole 40 feet deep at one setting. It is intended to bore holes up to 12 inches diameter in steel ingots with a maximum pressure of 100,000 pounds, and with a feed of 1-50 inch or about ⅛ inch per minute.

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## German Industrial Progress.

From a British source it is learned that the idea prevails in England that all that comes from Germany is cheap and bad. But a short tour through the chief manufacturing districts would soon show that the Germans are in possession of some of the finest machinery in the world, and that they know how to use it. Circumstances, such as the Welsh coal miners' strike, the coming into force of the new navy bill, etc., have combined to make the current year an eminently prosperous one for German trade and commerce, and therefore for the country at large. The mine owners and manufacturers have been quick to profit by the fortunate conjuncture, and, wisely enough, have employed the extra gains in renewing and improving their machine plant, thus increasing the dividend earning power of their business for years to come.

The Germans are especially proud of the efficiency they have attained in shipbuilding. They claim now to produce vessels as good as any that ever left a British shipbuilding yard, and that their only reason for having ships built in England is that they cannot themselves execute the orders with which they are flooded.

In electrical matters Germany takes the leading place among the nations of Europe. She has 711 miles of electric railways and tramways, equal to those of all the rest of Europe together. England is credited with a modest 98 miles. Most of the larger towns of Germany have electric tramways, and the whole tram system of Berlin will, by the year 1901, be converted into an electric one. American manufacturers should be in line for the contracts that are to be let.

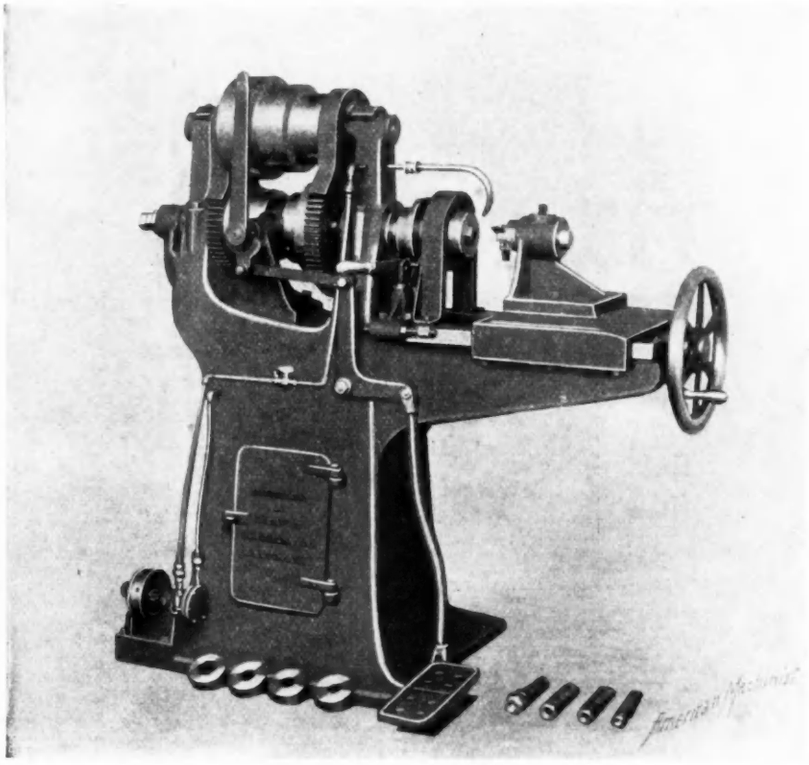
A. F. T.

▲ ▲ ▲

The handling of snow in cities is done by the most primitive methods—shovels and carts—and there is room for invention.

## A Nut Facer.

The half-tone shows an interesting machine specially designed for facing nuts—that is, it faces, chamfers, relieves the bearing side or removes the first thread as required. The nuts are run on and off the mandrel by the machine itself, and they cannot be so worked by wrench or hammer or other familiar mutilating device. The mandrels for the various sizes are readily exchangeable and are securely held by a suitable chuck. A collar or socket overhangs the threaded portion of the mandrel, with a square or hexagon hole in which the nut fits loosely. The main spindle of the machine is reversible either by the treadle or by the vertical hand lever. The socket for screwing the



A NUT FACER.

nuts on or off (changeable for the different sizes) is held from turning in either direction, when required, by a friction device operated by the short horizontal lever. The socket has no movement in the direction of the axis of the machine, the mandrel when chucked being so placed as to give the proper overhang to the socket. Three cutters are used in a single cutter-head, which is advanced or withdrawn by the hand wheel, an adjustable stop being provided for facing the nuts to a uniform thickness. The machine is made in two sizes, one for all nuts up to 1½ inches diameter, and the other for all sizes up to 2 inches diameter. The machine is made by the Detrick & Harvey Machine Company, Baltimore, Md.

## Steam Driven Road Wagons.

MR. WILLIAM B. MASON'S CARRIAGE.

Up to the present time the steam engine driven by an ordinary vertical boiler has not been regarded with very much favor by motocycle constructors. The steam engine in ordinary forms has a heavy, bulky boiler, a smoky fire, requires a large supply of water, and delivers a cloud of visible vapor into the air, accompanied by a noisy puffing. Such a steam engine is very clearly not to be made a component part of an elegant carriage for use on common roads, and until the appearance of the Stanley steam carriage, begun July 6, 1897, and first placed on the road in October, 1897, and only just now (October, 1898) completed, no steam driven road carriage has ever been shown which was reasonably still, smokeless, odorless, and even tolerably unobjectionable, excepting, possibly, the Whitney wagons, which I have not yet seen in operation. Hence motor carriage makers have in the main viewed the steam engine with disfavor and have turned their attention to the gas engine as the more suitable for propelling mechanically driven wagons on common roads.

The gas engine requires no boiler and no fire, consists essentially of only a very few parts, easily made, and is very economical in the use of fuel. For these reasons the motocycle makers have mostly used gas engines, and have attained an entire mechanical success with these motors, which use no boiler, emit no smoke or other visible vapor, that is to say, are supposed to show no visible vapor, and weigh much less per horsepower than steam engines with boilers. But the gas engine has certain fixed and highly objectionable characteristics for the service which no one so far has been able to remove.

The Otto cycle seems indispensable. This "cycle," in which the piston makes one working stroke acting to drive the crank-shaft and then has to be driven by the crank-shaft for the next three strokes, calls for a heavy fly-wheel, for a very high crank-shaft velocity, and a train of reducing gear of some sort between the engine and the driving wheels. It is also difficult to make a gas engine which will run both ways, so difficult in fact that none of the motocycle builders, so far as I know, are attempting to reverse their gas engine motors, but are using reversing gears in the train between the motor and the driving wheels.

Then there is the odor and the fact that the gas engine requires to have a water-jacket for its cylinder, and if the water-jacket circulation is not kept up there is trouble.

The steam engine, on the contrary, is one of the most docile and obedient servants known in the whole round of mechanical agencies. It runs either way and at any speed, it drives constantly, and is four times as effective as a gas engine of the same cylinder capacity, hence could the boiler but be made light, and the smoke be made invisible and odorless, and the exhaust steam done away with, a steam boiler and steam engine might do nicely for driving road wagons. These steam engine changes seem to an engineer about as impossible as could be imagined, and until very recently I, who have given the problems of the motocycle much attention, did not dream that there was even the possibility of a steam boiler light enough and clean and smokeless enough to make the steam engine an acceptable motor for an elegant passenger carriage.

By his own story it was the sight of a steam road roller which induced Mr. Stanley to begin building a steam carriage. "I just said to myself," said Mr. Stanley, "all I have to do is to build a steam carriage to weigh about 400 pounds, and I am all right." Why or how the figure of 400 pounds was assumed was not told. I, after a somewhat extended consideration, came to the conclusion that in view of the pneumatic tire a light passenger motocycle should not weigh over 400 pounds, but Mr. Stanley is not an engineer and does not appear to have fixed on 400 pounds for the weight of his motocycle for any better reason than that he thought 400 pounds was about right. Having abundant means, self confidence and energy, and a thorough contempt for precedent and authority, Mr. Stanley

ordered an engine of the Mason Regulator Works, Milton, Mass., and a frame and running gear of the American Waltham Manufacturing Company, Waltham, Mass., builders of the "Comet" bicycles, and went to work on the boiler and burner and fuel problem himself. As to the frame, Stanley claims it as his own design, wholly. As it was built at the Comet shops and was the subject of many alterations before it assumed its present form of irreproachable elegance it seems not wholly improbable that some ideas from the Comet frame constructors may have found a lodgment in the completed structure.

Although the Stanleys were not engineers, much less boiler makers, they produced a vertical tubular boiler, 14 inches diameter and 13 inches high, containing 306 ½-inch copper flues, 20 B. & S. gage, and a burner for firing the same flue length, and the same fuel, but made an entirely new burner, and also devised a wholly novel and original method of boiler construction. Whitney's engines are alike in all his carriages, 2⅛-inch bore by 4-inch stroke. Stanley's engines are 2½-inch bore by 3½-inch stroke, and the Mason engines, which drive the beautiful wagon here illustrated, are 2-inch bore and 3-inch stroke.

Stanley used Mason's regulator for governing his fire, as did Whitney, and as does the "Seminole," and Stanley furnished his boilers and burners complete to Mason and the Comet shop, and the Comet shop built the frames for the Stanley wagons, and for the Mason wagon, and for their own "Seminole" steam carriage. Hence it will be seen that only a very misleading story of the Mason carriage could be written without this extended mention of Stanley's work and the Comet cycle shops.

The Stanley brother whom I met permitted me to take outside pictures only of his carriage, and was not willing that any detail description of his machinery should be printed. Mr. Mason, however, who uses substantially the same essentials, the same frame and a Stanley boiler, was willing to have his carriage fully illustrated.

It is of course impossible for the writer to say how the appearance of the Mason steam wagon will impress the non-mechanical observer, but to the engineer's eye it is certainly a very beautiful structure. The finish, in black and nickel plate, is of high polish, the proportions are elegant, and all of the details are in correct steam engineering form, the lever stand, Fig. 9, the adjustable stroke pump mechanism, Figs. 7 and 8, and the clock, gage and cyclometer board, Fig. 10, being especially pleasing to the trained eye.

Fig. 1 shows Mr. Mason sitting in his carriage in the yard of the Mason Regulator Shops, Milton, Mass. Fig. 2 is a front view of the complete vehicle. Fig. 3 is a view as much in plan as could be readily obtained with the camera. Figs. 1, 2, 3, 6 and 7 give a good idea of the form of the tubular steel frame, which consists essentially of two well-braced vertical girders, which form the front and rear ends, connected on top by two tubular compression members, which support the body, and underneath by double lattice braces. The frame is shown in some of the brace details in Figs. 6 and 7. This is a very excellently designed frame, polished and enameled and nickel plated to the highest finish.

The wheels are all called 28-inch diameter, and have Fairbanks' laminated wood rims, cycle suspension spokes and ball-bearing hubs. The gage or tread is 50¾ inches, and the wheel base is 56 inches. The load on the wheels is about equal. The wood rims measure 25¼ inches diameter at the bottom of the tire groove, and as the tires are 2 inches diameter the actual wheel diameter is about 29 inches, although the wheels are rated as 28 inches. The tires are ordinary 2-inch cycle tires, made by the Newton Rubber Company, and cost only $16 per set, as against $120 a set for the New York cab tires, and $200 per set for the best tires which Riker, of Brooklyn, uses under his electric carriages. These Mason tires are used with about 80 pounds air pressure. The Mason steering lever is hinged well down to the foot rug and close to the inside of the dashboard, making it very convenient when in or out of use.

In Fig. 3 the backboard is taken off,

FIG. 1.—MR. MASON SEATED IN HIS WAGON.

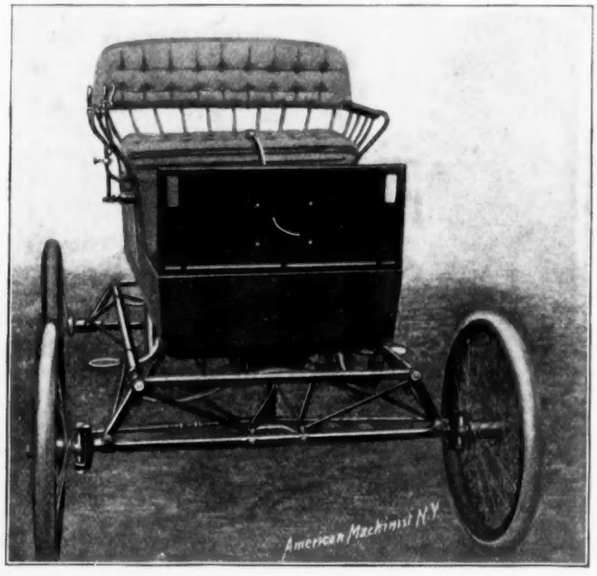



FIG. 2.—FRONT VIEW OF MASON'S STEAM WAGON.

same with vaporized gasoline, which is noiseless and produces so near an approach to perfect combustion that the "smoke" is perfectly invisible and wholly odorless.

Sylvester Roger, of Boston and vicinity, built one or more steam motor wagons some score of years since, using, I think, vertical tubular boilers. Mr. George E. Whitney began building steam road wagons at East Boston as early, I think, as 1894 or 1895, and at the time the Stanleys began on their wagon had completed some thoroughly practicable steam-driven motocycles, one weighing as little as 750 pounds. All of these Whitney wagons used vertical tubular boilers, and the boilers were about 14 inches diameter, 13 inches high, used ½-inch copper tubes, and were fired with vaporized gasoline.

The Stanleys took very nearly the same boiler diameter, and exactly the

showing the smoke bonnet on top of the boiler. The smoke exit is not upward, but downward, through a nickle plated smokestack, seen in the rear of the hind wheel, which is in the foreground of Fig. 3.

Figs. 4 and 5 are right and left views of the engines, which are fully exposed by the removal of the cushion and seat boards and the floor-board. These engines are fitted with piston valves with a link action, and have also a 12-pound fly-wheel, which does not seem to be needed. Mason thinks it useful, but as the Stanley carriage runs to perfection without a fly-wheel, it is hard to see the need of one in this similar wagon. These are complete engines of the marine type. The boiler has glass water gage and all the usual cocks.

Fig. 6 is a left-hand view of the rear sprocket, compensating gear and brake and axle yoke, in which the two ends of the divided rear axle are supported, all on ball bearings. The brake band is leather faced, and is pulled forward at the top end, thus making the wagon help to apply the brake, and forcing the brake full on as soon as the brake treadle spring resistance is overcome by the foot. The chain is a standard cycle chain, 1 inch pitch with hard blocks. The chain blocks are 3/8 inch wide and the sprockets 5-16 inch face, all hard, that on the engine shaft having 8 teeth, while that on the compensating gear case has 32 teeth, making the speed reduction from the engine shaft to the rear axle 4 to 1. The chain and sprockets and the working parts of the engines are all exposed to the road dust; these parts should undoubtedly be all perfectly incased, and probably will be. If they were protected from dust I can see no reason why they should not be durable.

Chain adjustment is effected by a right and left threaded strut leading from the compensating gear yoke to the crank shaft support, the whole engine being pivoted to swing on the steam pipe.

Fig. 7 shows the right-hand side of the compensating gear box, which is formed with an eccentric groove, taking a roller on the end of the slotted pump lever, all as clearly shown. This gives an adjustable pump stroke, and the pump rod is extended to drive the cyclometer. The water line is supposed to be 8 inches above the fire sheet, but an inch more or less makes no great difference, and having an adjustable pump stroke it becomes easy to find, by trial, a constant pump plunger travel which will hold the water where it belongs, as one 10-mile run on the road will take about the same water as another 10 miles, the day through.

Fig. 8 shows the lever stand on the right-hand side of the wagon. The short lever in front has a spring plunger hand

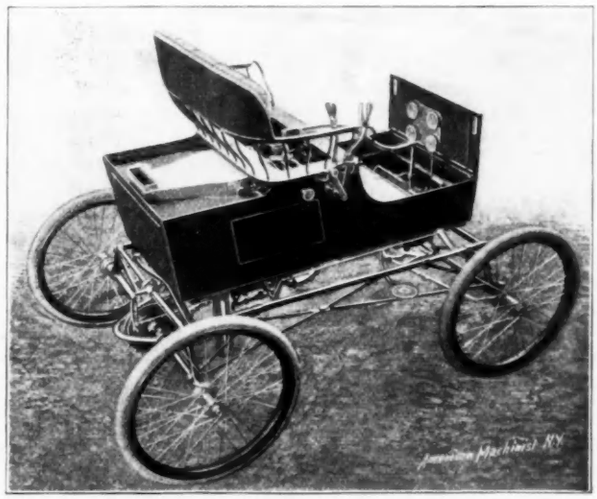


FIG. 3.—MASON STEAM WAGON—TOP VIEW.

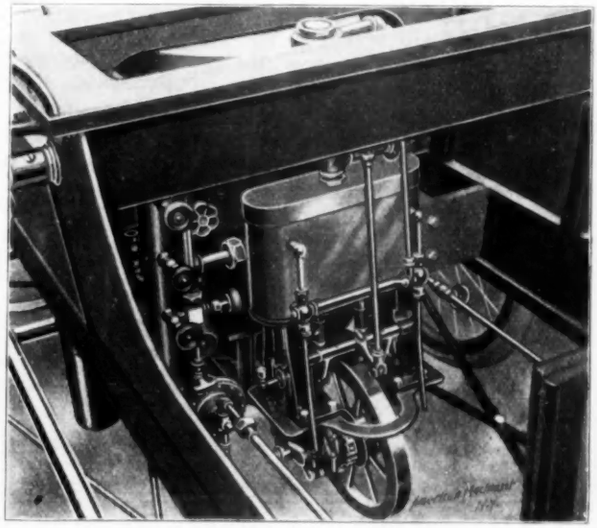


FIG. 4.—RIGHT HAND VIEW OF MASON'S ENGINE.

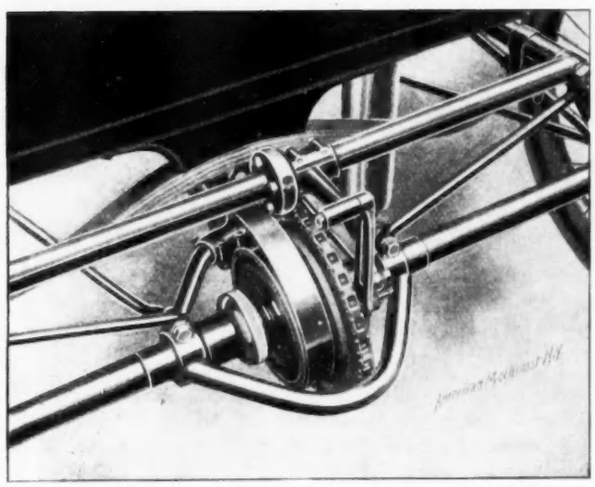


FIG. 6.—REAR AXLE CONSTRUCTION, MASON'S STEAM WAGON.

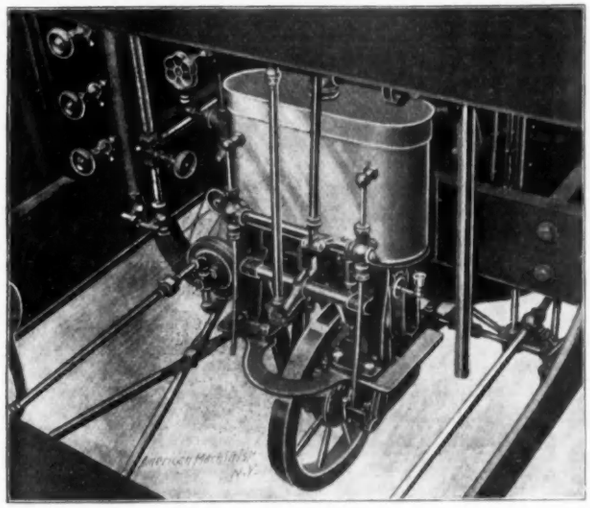


FIG. 5.—LEFT HAND SIDE OF MASON'S ENGINE.

knob, and stands in one of two positions. The middle lever operates the tumbling shaft and governs the link positions. The inside lever operates the air pump, by which air pressure of about 25 pounds is maintained in the gasoline tank. This Mason wagon had never been on the road when these pictures were taken; in fact, it was run out of the shop for the first time for the purpose of obtaining them. The performance of the wagon will be given in a second paper. The Stanley wagon runs about 25 miles with two passengers upon one gallon of gasoline; cost, 7 cents for fuel. The Mason wagon, having a link valve motion, may be expected to do as well as this, or a little better; that is to say, to carry two passengers in great comfort for a fuel cost of well under one-third of a cent per mile. This is a wonderfully low figure, and it seems not at all extravagant to say that this group of Boston steam wagons marks an era in the development of the mechanically driven road wagon.

Fig. 3 shows the gage board placed on the inside of the dashboard. This board carries at the bottom a boiler pressure gage and a gasoline tank pressure gage, an eight-day clock on top at the left, and a cyclometer operated from the pump rod at the right. The cases are nickeled, and everything is polished to mirror surface. Taken all together this Mason carriage is the most beautiful thing in the way of a motocycle I have ever seen. Its weight is somewhere about 450 pounds probably. The Stanley wagon weighs about 400 pounds, and the Mason engine has a fly-wheel with a 12-pound rim and a link valve motion, which do not appear in the Stanley vehicle. The Mason boiler and burner weigh about 95 pounds, and the engine weighs 38 pounds, just double the weight of the larger Stanley engines.

Mr. Mason started to build a steam motocycle in 1885, but sold the running gear when partly finished. Next, beginning in May, 1897, Mason built a horizontal double engine for Stanley, to order. Next a pair of vertical engines, now in the Comet's "Seminole" wagon, cylinders 2x3 inches, piston valves, link motion. Then Mason built to Stanley's order a pair of engines, cylinders 2½x3 inches, inclined slide valves and link motion, finished in July, 1897. Then came two more vertical double engines to Stanley's order, making four experimental engines for Stanley in all. Finally, about July, 1897, he began the engines now in the carriage here illustrated.

HUGH DOLNAR.

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## The Card Index for Notes and Clippings.

Mr. Frank G. Du Bois, of 512 West Thirtieth street, New York, calls my attention to an injustice done him in the article published under the above head in the issue of October 27. That article states that the file is no longer on the market and that it never found favor with the public as a letter file. Mr. Du Bois states that the file is still an article of manufacture, and that of several thousand sold none, so far as he knows, has failed to give entire satisfaction. There has been some interruption of the business due to a disastrous fire, and it was through this that I obtained the impression that the sale of the file had been discontinued. One of the regular sizes made by Mr. Du Bois is 16x9½x7 inches inside, which is well adapted to the filing of clippings folded to standard size. Having conveyed the contrary impression, it is due Mr. Du Bois to say that the file is a patented article.

We are also in receipt of a letter from Mr. Herbert Marshall, of Gainsborough, England, saying that he has used a similar file for notes and clippings with great satisfaction, and with the letter he sends a catalogue of the English makers of the file—the Ceres Depot, 16 Brook street, London. This catalogue shows the file adapted to a great variety of uses, and conveys the impression that it is much used in England.

F. A. HALSEY.

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## An Improved Extension Boring Mill.

The half-tone shows a large extension boring mill with a new and important feature. The mill shown is normally a 12-foot mill with provision for moving the uprights and cross rail back to make it, when required, a 20-foot mill. In the construction of mills of this type, whether by the present builders or by others, the design has necessitated the use of the machine in either one or the other of the two positions when boring was to be done at or near the center regardless of the actual size of the work. For the use of the machine when extended to the larger dimension a projecting central arm has usually been provided, to be clamped to the cross rail and carrying a vertical bar over the center of the table. As this bar has thus had but the one position, and has usually been not too rigidly held, it could usually be used for boring only, and if the boring required was of large diameter the holding of the tool has been for some work still a perplexing problem. The arrangement here shown speaks for itself, and will be at once appreciated. The extension provided for the third tool bar has a horizontal slide on which the saddle may travel and carry the tool anywhere from the center to the periphery of the piece to be turned up to the full ca-

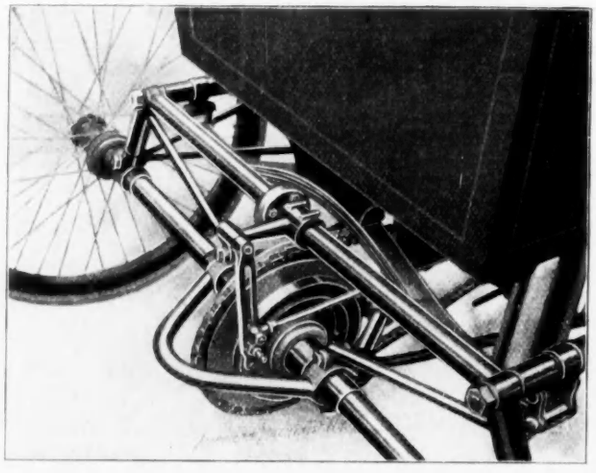


FIG. 7.—PUMP DRIVE AND CYCLOMETER ACTION, MASON'S WAGON.

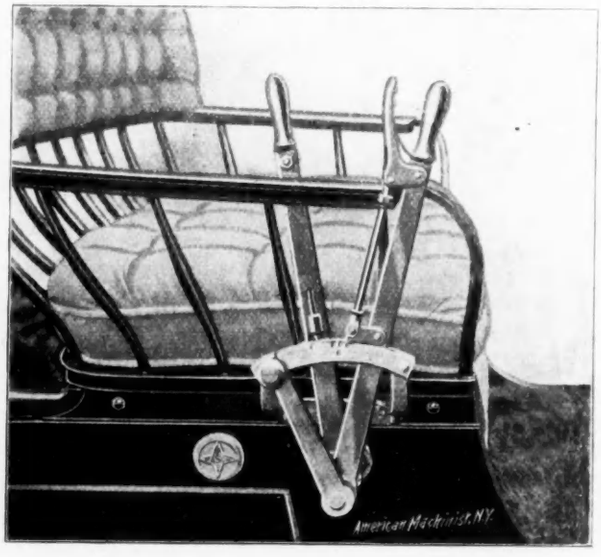
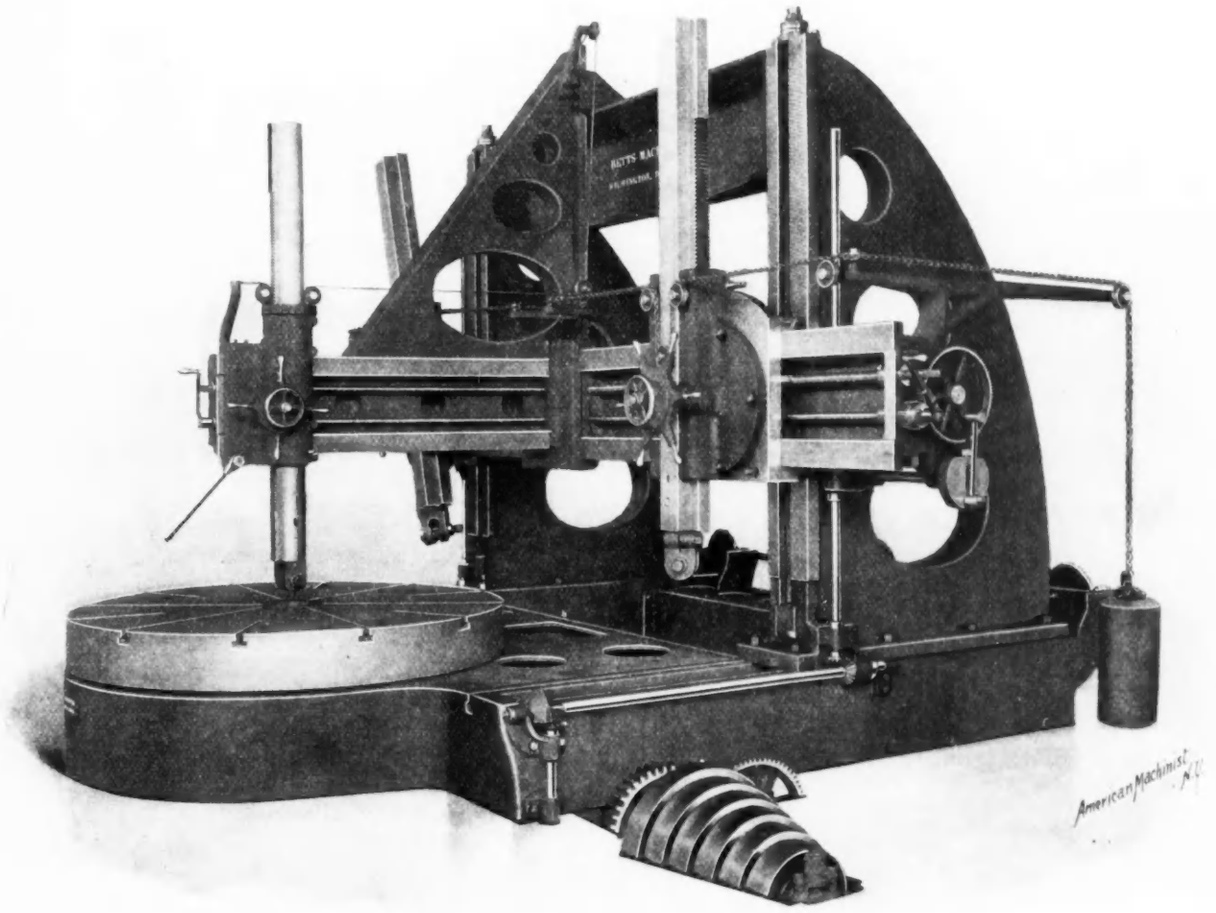



FIG. 8.—REVERSING LEVER, AIR PUMP LEVER AND CYLINDER COCK LEVER, MASON'S STEAM WAGON.

pacity of the machine. The projecting slide is also provided, as will be seen, with an upright slide stiffened by a strong buttress and with a clamp which fastens securely to the crossbar of the housing. It is thus never necessary to move the housing back to the 20 foot position except for 20 foot work, while for any smaller diameters from 12 to 20 feet the housing is moved back only sufficient for the diameter required. The third tool bar is no longer a boring tool only, but may be used for facing or for any required boring or turning from the center to the periphery. With this tool it would be a simple matter to entirely face a circular plate 20 feet in diameter. The machine has all the well-known features common to all similar machines of the builders. It has the worm drive for the table with twelve changes of speed and the full range of feeds for each tool bar. The uprights are moved in and out by power, the gearing for the purpose being partially visible at the back. The feed motion is always in connection without looking after, whatever position the housing may be in. The machine is built by the Betts Machine Company, Wilmington, Del.




AN IMPROVED EXTENSION BORING MILL.

# Letters from Practical Men.

## An Appreciated and Happy Draftsman.

Editor American Machinist:

Reading of the unappreciated draftsman in issue of October 27, I feel it my duty to give him a few words of encouragement from a man who does not feel oppressed. First, I would say that one of my methods has always been to ask questions and plenty of them; in fact to display my ignorance as much as possible. Taking, for example, the drawing of the long train of wheels made by our friend "Oppressed," I would have gone out into the shop, caught the foreman or superintendent, and had a little chat with him about the machine, telling him that I considered the fact of his years of experience compared to my small fund of knowledge, and that he perhaps might find it quite possible to offer me some suggestion relating to the mechanism of the machine that would be of value to me in making the drawing, and this, I am sure, would draw him out to go over the details with me and place me where I could know I was right and sure of making more speed, having the approval of the foreman for my work when finished. Then, if the machine should not work correct, the fault would be placed elsewhere than on my shoulders, or would be properly hushed.

I always keep in touch with the shop foremen and work them up to a good opinion of yours truly, which will often cause a good word relating to my drawings to go in where it will do the most good. I have also discovered that following up a drawing after it goes into the shop is an excellent plan. Perhaps I drop into the shop at the noon hour, and take a look at the work as it progresses, with the result that I am sure to learn of something that could have been made a little better, and the same I store up for future reference, often making notes of points found in this way.

It is very often possible to find an intelligent machinist that can talk machine design and offer improvements that would make me blush with shame to think that I had not thought of the same myself while I was working on the drawings. I have found many machinists and

toolmakers who are out of their sphere at the bench or running a lathe, and who should instead be at the drawing board working on difficult problems and discovering wonderful new mechanical motions.

It would perhaps be out of place to write anything for our English brother relating to wages in the drawing room compared to that of the shop. I have discovered, however, that with us the pay is far better for the draftsman than it is for the shop man. I would not be afraid to say that few first-class machinists or toolmakers get more than $3 per day of ten hours, and more often take less, where an ordinary draftsman with some shop experience can command at least $4 per day of eight hours' work, and usually more than that figure.

Another advantage the wide-awake draftsman has is the opportunity of meeting mechanical engineers, prominent machine men and inventors, and perhaps being selected to represent his employers at exhibitions and displays of machinery or the product of his own pencil and pen. In fact, I would judge one of our craft sleepy and slow who does not get well in touch with the management, making himself known and felt, thereby receiving in salary all he is worth and perhaps a little more. MAC.

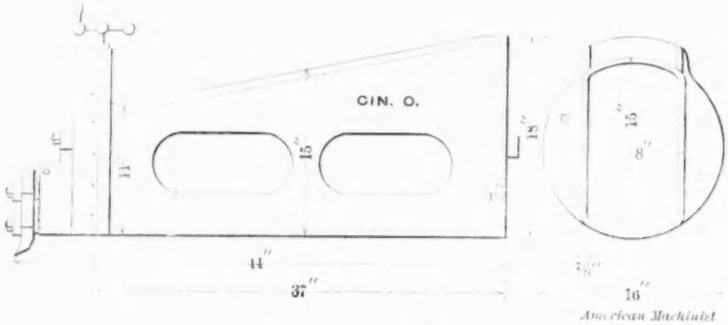
Baltimore, Md.

▲ ▲ ▲

## A Long Planer Reach.

Editor American Machinist:

As I have at different times seen clever and useful shop kinks in your valuable paper, I take the liberty to submit the following designed reach, which, I think, is a good one. It often happens in a shop that there are jobs of planing that will not pass through the largest planer, and that still there is hardly enough other large work in the shop to make an investment in a larger planer pay. Then




A LONG PLANER REACH.

it comes handy to have a good reach within reach. The sketch I send is of one I saw in use in a prominent shop of this city. It is made to bolt against the saddle on the cross rail the same as the regular head. The casting is cored out and so shaped as to give it stiffness without unnecessary weight. While this may not be anything very new, its length of reach, 44 inches, or about 36 inches increase, and the way is stood up to a cut of 3/8x1-16 inch made it noticeable. This style of a reach might be made so that the regular planer head could be put on it, and with a small shaft running through its center be geared up for down feed. It was a planer 73 inches between the housings that this reach was used on. There may be longer reaches than this one in use, but I have never seen one.

H. L. CAMERON.

Cincinnati, Ohio.

▲ ▲ ▲

## A Device for Chucking Elbows.

Editor American Machinist:

I offer your readers sketches and description of a novel little chuck seen in operation in a brass-working shop, for holding brass elbows for machinery in the turret lathe. The elbows required drilling, tapping and facing true, to exact right angle, which was found very difficult and unsatisfactory with the old two jaw chuck; the tool here shown seemed to be about the correct thing for the job.

Fig. 1 is a sectional view, Fig. 2 is a front elevation, and Fig. 3 a set of jaws for a 3/4-inch elbow. *A* represents the body piece of cast iron, fitted to the turret lathe spindle, the base being left to balance the mechanism at the top. *B* is fitted to swing inside of the main casting and held in place by the cap *C*. The holder *D* for the removable jaws is of tool steel, hardened, and fitted to the swinging casting and held by a screw *d*.

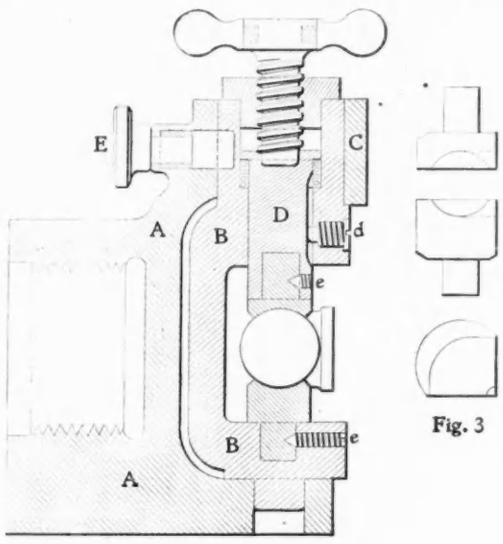



Fig. 1



Fig. 3

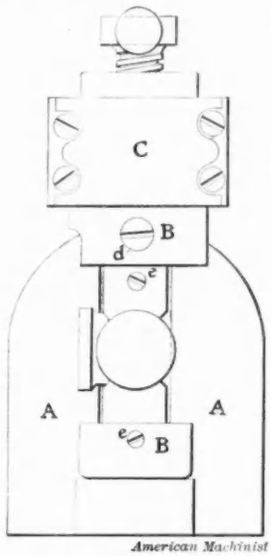



Fig. 2

A CHUCK FOR ELBOWS.

which enters a slot, keeping the holder from turning, but allowing it to slide freely longitudinally. The coarse-pitch screw, with its handle, does the work of tightening the jaws, the opposite jaw being fixed. The nut for the tightening screw is a press fit and pinned stationary into casting *B*.

After machining one end of an elbow, the spring index pin *E* is withdrawn and casting *B*, with elbow tight in the jaws, is swiveled a quarter turn and again locked by the index pin; the operations upon the other end of elbow may then be performed at an exact right angle with the first.

The chuck complete makes a tool not nearly as heavy as the ordinary turret lathe chuck, and is not very expensive to build, the most costly operation in its manufacture being the boring of the holes in the body piece for the swinging casting *B*. The device was made in two sizes, taking all elbows from 1/2 inch to 1 1/2 inches, with ten or a dozen pairs of jaws, which are interchangeable and held in place by the small set screws shown at *e e*.

D. E. MACCARTHY.

Baltimore, Md.

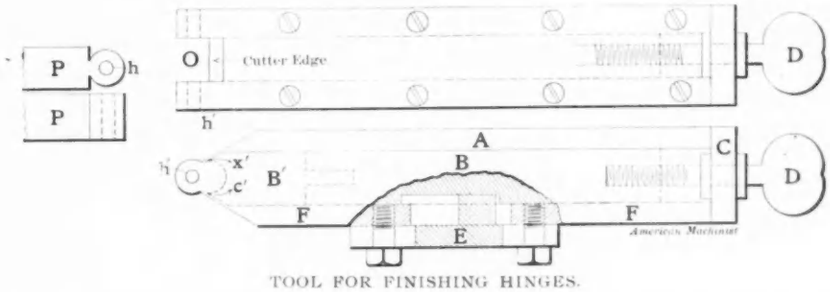
▲ ▲ ▲

## Tool for Finishing Hinge Hubs.

Editor American Machinist:

I consider it a duty to try to do something in return for the many ideas that have come to me from the columns of the

"American Machinist," so I send you a sketch of a little tool for finishing the cylindrical part of a hinge joint that must be nice and true, and that is done very neatly by this tool. The hub to be trimmed is shown at *P*, which is the end of a piece long enough to be used as a lever for doing the work. The piece is milled and finished on the flat sides, and the end for the joint is rough milled to shape, but with stock left for finishing. The shoulders forming the acute angles where the cylindrical part attaches must




TOOL FOR FINISHING HINGES.

be finished to their full depth to enable the cutting lips to clear. The hole *h* is drilled, and when ready for shaving the cylinder, the piece *P* is slipped into the jaw *O* and a pin is inserted at *h* upon which the piece may be oscillated, this being done by hand. While this is being moved back and forth the cutting lips *c' c'*, fed forward by the thumb screw *D*, trim the cylindrical surface as desired. The tool consists of the main piece *F*, which has a rectangular channel in which slides the piece *B* with the cutter *B'*, and is held in place by the cover *A*, which is secured by countersunk screws. The end piece *C* is also secured to *F* by screws. *E* is a stop fastened to the under side of *F* with a tongue projecting up into a groove planed across the bottom of the piece *B*. The end piece *C* is slotted on one side to allow the screw *D* to slip into place.

C. H. WILCOX.

Springfield, Mass.

▲ ▲ ▲

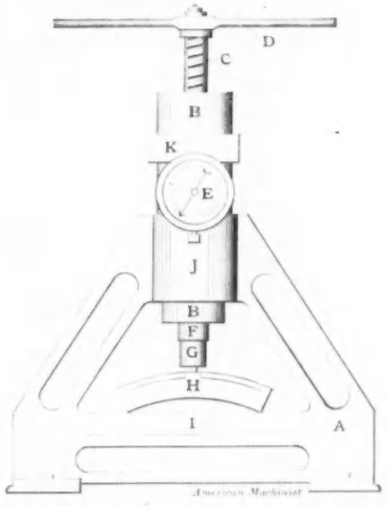
## A Testing Press.

Editor American Machinist:

This unique device was designed and built for the Corning Iron Works some years ago and is still used by them for tests. It was made for breaking the ordinary test bars and special forms that come up, but the principal use it is now put to is in testing the brake shoes manufactured by this company. The shoes made are of a composite design which consists of a soft inset in the face of the shoe, called the "serpentine chill," and the iron surrounding it. This "chill" is made first, and as the name suggests is somewhat of a snakelike form. When the shoe is to be cast the chill is placed in the mold in the position which it is to occupy, and when the hot iron is poured it, and not the chill, is made hard. This method makes a casting which is necessarily weak and likely to break under the powerful thrust of the air brake piston, and it was only after many trials of different mixtures and various distributions of the metal that a satisfactory design was obtained.

In work of this character there is very little precedent, and theories of stress and elastic limit do not count for much without a practical test. As stated by the foreman molder, the mechanical operation of "setting up" these brake shoes counts for very little, but he has found that the trouble required to always get positive results far exceeds that for some large and intricate castings.

The sketch of the press which was so largely used to get the best results will not need much explanation, as it is a combination of the screw and hydraulic press principle which is largely used in




A SCREW HYDRAULIC TESTING PRESS.

hand boiler punches. The frame *A* is of cast-iron with an enlarged part *J*, which is bored out for the steel cylinder *B*. This cylinder is in two parts and is screwed together with collars on each side of *J*. The upper part is formed with a hexagon *K* for the wrench that is used to screw the two parts together, and it also forms a nut for the screw *C*. This screw *C* is squared on the upper end for the handle *D*, and the other end, reduced in size, is a piston with cup leather packing.

The driven piston *F* is larger and also has leather packing. The thrust is taken by the distance piece *G*, which is provided with a mushet steel inset. A gage registers the pressure, and, as usual with gages subjected to a sudden fall in pressure, is provided with a check valve. The break shoe or other piece to be tested rests on the steel bed *I*, and can be subjected to a very heavy pressure with comparatively little effort on the part of the operator. Fifty or sixty tons can be applied without trouble.

FRED E. ROGERS.

Corning, N. Y.

▲ ▲ ▲

## The Power Cost of Injection Water for a Jet Condenser.

Editor American Machinist:

In the "American Machinist" of October 20 an interesting question is reasked by Mr. Tecumseh Swift. Briefly stated it is this:

In the case of a jet condenser the injection water may be derived from a source which is either at a lower or a higher level than the mean water level of the condenser; in the former case more work has to be done, as in raising the water a certain amount of energy must be expended; whence is this energy derived? And how would its disappearance affect a theoretical balance sheet of heat and work? Apparently the same quantity of water is required in either case, and at any rate, so far as observation goes, the vacuum is by no means impaired; how then does the doctrine of the conservation of energy apply to this case?

I have endeavored to supply a short answer to these very pertinent questions, and the problem is both an interesting and instructive one, and worthy of the attention of all mechanics who wish to grasp at the "true inwardness" of things. In order to institute a rigid comparison between the two cases and to fix one's ideas let it be assumed that there are two condensors, *C* and *C*, of Figs. 1 and 2, of precisely the same dimensions, and at the same temperature—say 141° and corresponding pressure, 3 pounds per square inch. In Fig. 1 the injection water is represented as entering by the cock *B* from a tank *A*, the mean water level of which is 20 feet above the level of the aperture in *B*. In Fig. 2, however, the level of the supply tank *A* is 20 feet below that of the aperture in the injection cock *B*. Let it be supposed that the injection cocks are so regulated that exactly the same vacuum is produced, it being assumed for the purpose of argument that very minute differences of pressure may be detected, and that by very fine adjustment of the entering water the pressure may be maintained at will.

In the case illustrated by Fig. 1 the effective head of the entering water is 20 feet by the head, due to the difference of

pressure between the atmosphere and the condenser, and the latter quantity is approximately 27 feet (27 feet head is "equivalent" to a pressure of 14.7-3 = 11.7 pounds per square inch). Neglecting frictional losses in the pipe and orifices the velocity of the water at entry is that due to a head of 27+20, or say 47 feet of water, and each pound of the entering water possesses energy of motion to the amount of 47 foot pounds, which is dissipated almost immediately in the form of eddies, resulting in a net gain of heat to the contents of the condenser of 47-772

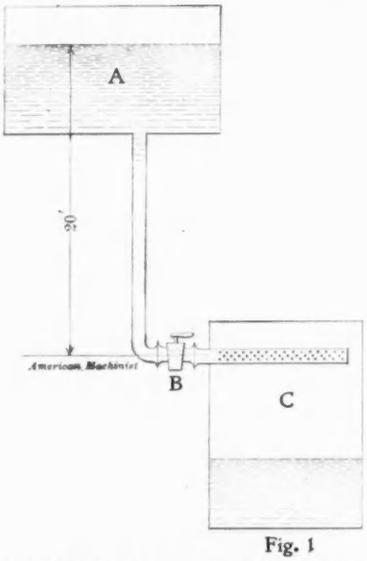



Fig. 1

WATER SUPPLY ABOVE CONDENSER.

heat units. That is to say, that each pound of water brings with it in the shape of energy of motion 47-772 heat units more than if the water entered without perceptible motion.

In the case of the water entering from a lower level, illustrated in Fig. 2, the effective head is reduced to 27-20 feet, or 7 feet, and the velocity of entry is correspondingly reduced, and the excess of energy per pound of water entering, over that of 1 pound of water entering without perceptible velocity, is in this case reduced to 7 foot pounds, or 7-772 heat units. It would therefore seem that the arrangement of Fig. 2 possesses in theory a minute but calculable advantage, since the water brings with it less energy of motion (to be afterward dissipated in heat by internal friction); and, consequently, to condense the same quantity of steam and maintain the same vacuum, a smaller quantity of water is required in the case of the condenser of Fig. 1. This difference is quite inappreciable in practice, of course; but it exists in fact, and is, within certain limits, quite calculable.

It may be urged that the foregoing argument, though unassailable, does not clear up but rather confuses the main issue. After all, it may be asked, why is it advantageous to do extra work? Before replying to this question, it may be useful to ask and answer another: what is the true function of the condenser? From the mechanical point of view, it is desirable at the least expenditure of energy in pumping to maintain the highest vacuum; from the purely thermal point of view, to give to the "sink of heat" all the heat rejected by the engine, at the lowest available temperature and at the expenditure of the least power.

It will now be clear, if the last principle be kept in view, that after the lowest available temperature has been reached by the working fluid it only remains to give up the heat remaining in it as expeditiously as possible. During the process of the formation of steam, work has been

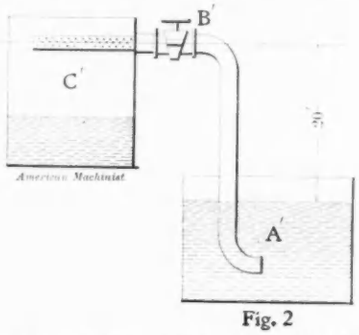



Fig. 2

WATER SUPPLY BELOW CONDENSER.

done in pushing back the atmosphere; in the process of condensation matters are reversed, inasmuch as the atmosphere does work in forcing in the injection water.

It is obviously an advantage that the entering water should have as little energy in the form of motion as possible, since its function is solely to absorb and carry away heat, and it will therefore be a positive advantage if the energy of the entering water is absorbed in doing work against gravity instead of in creating heat in that organ whose proper function is the abstraction of the same. It is also proper to observe that in the case of water entering from above not a jot less work is performed by the atmosphere, with the additional disadvantage that its superior potential energy (energy, that is, in virtue of its position) is converted at entry into kinetic energy, which is finally absorbed in the form of heat in the very organ which is expressly designed to take heat from the engine.

R. A. BRUCE.

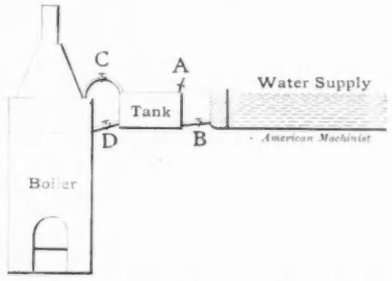
Chatham, England.

▲ ▲ ▲

## Feeding a Boiler for Nothing.

Editor American Machinist:

Can we feed a boiler for nothing? Yes, if we have a supply of water whose level is a little above that of the water in the boiler. Here is how to do it: *A* is an air cock to let air out of the closed, steam-tight tank; *B* is a cock to let water into the tank; *C* is a cock to let steam from the boiler to the tank; *D* is a cock to let water from the tank to the boiler. The bottom of the tank should be above the highest water level to be carried in the boiler. The lowest level of the water supply must be higher than the bottom of the tank. To feed the boiler, first close *C* and *D* and open




HOW TO FEED A BOILER FOR NOTHING.

*A* and *B*. Water will then run into the tank. Then close *A* and *B* and open C and *D*, and the water in the tank will run into the boiler.

W. K.

▲ ▲ ▲

## Section Coloring for Working Drawings—Methods of Shop Management—Dynamometers.

Editor American Machinist:

I have noticed quite recently in your columns comments on the cross sectioning of shop drawings. I believe that there is a great deal of valuable time wasted in attempting to cross section detail drawings with the arbitrary and conventional lines used to denote different metals and woods, none of which are recognized as a standard and are liable to cause considerable confusion. I also think that the scheme of writing the name of the metal on the sections is not altogether satisfactory, and would say that for a number of years I have advocated the use of colored crayons to represent the different metals, which show of course extremely well on the original drawing, especially if it be made on bond paper, which I think is far and away preferable to making original drawings on brown paper and then going to the expense of tracings, as the blue prints can be made from the bond paper directly. The crayons also take very well on blue print paper. The labor involved in roughly cross sectioning with crayons is very slight, and there is no question that the resultant effect is to make the drawing very much clearer and less liable to error than the ordinary work. Not only can cross sectioning be strongly brought out in this manner, but elevation or plan view also, by the simple method of drawing a crayon line of the proper color just inside of the white line denoting the shape of the piece.

I have heard for a good many years a great deal of fun poked at the drawings

made in Germany, in which a good deal of time had been expended in coloring up different sections and shading up plans and elevations, and agree that a great deal of time can be wasted in this manner; but at the same time this treatment does result in making the drawings much more comprehensive and easily distinguished than a flat line drawing or blue print, and believe that the same results can be produced with very little labor and with approximately the same result by using colored crayon pencils, which are very easily manipulated. I inclose you blue print very roughly done in this manner to show you the effect. Would also call your attention to the lettering on this drawing, which was done with a common rubber stamp used with opaque ink, as a labor saving method of stamping drawings.

I have also been very much interested in reading the contributions by "Quirk" on "Reform Shop Methods," and agree with him that it is almost useless to effect any great improvements through the effort of any old management or by attempting to copy the reports or performances in other shops. I have believed for a long time that the only way to accomplish the desired result is to employ an expert who has made an unprejudiced and unbiased study of this subject, who can come into your shop with "no axe to grind" and no other policy to prejudice him than that of increasing the output of the plant. He will then have to study the character of the work performed and formulate schemes for this increase, taking into consideration the class of work to be done and the purpose for which it is to be used. A person, to carry out this scheme successfully, must possess not only a well grounded, practical mechanical knowledge of the trade involved, but also be a judge of human nature, and have sufficient tact to enlist the sympathies of both the workmen and foreman in charge of them.

I believe that it is also necessary to have some form of premium system of payment, so as to appeal at once to the pocketbook of the workmen, to make an absolute and lasting success of any scheme for increasing the quantity and quality of work in a manufactory, as this at once enlists the efforts and interests of all the operatives in the scheme, and all of the employés, who are going to be of any further use to the company, are vitally interested in seeing the changes carried out to a successful issue.

I have also been very much interested in the articles by Mr. Flather on a new form of dynamometer for both transmission and absorption, and if he can get springs sufficiently well made and eliminate and calibrate the friction of the plungers in the cylinders I think the instrument would be quite valuable in the hands of an expert; but I believe, from quite a long experience with different types of dynamometers, that, for a transmitting dynamometer to weigh closely and accurately the power required to drive any form of machinery, there is no instrument which so nearly eliminates its own friction, and in which the friction is so constant for different amounts of power transmitted, as the bevel gear dynamometer which has been so often described; and, after an even longer and more exhaustive practice with all forms of Prony brakes, I have come to the conclusion that the simplest form of absorption dynamometer and the easiest to handle, is a common large volume capacity fan blower, which can be readily calibrated so that different openings in an air gate placed in the discharge from a fan at different rates of speed will represent exactly known amounts of power absorbed. I know of a number of steam engine manufacturers who have one or more fans thus connected to a short line of jack shaft in their engine testing room, to which they belt their engines under test so as to absorb the power and determine the efficiency of their engines, and also to adjust the shaft governors of the same, as it is very apparent that the changes of load can be very quickly and readily made by simply pulling in and out the blade of the air gate in the discharge of the fan.

This kind of a power absorption and measuring plant does away entirely with water-cooled pulley rims, which are always splashing over the floor, or smoke from the burning friction brake blocks, is in every way extremely clean and neat and has the usual elastic belt connection between the prime mover and the power absorbent that is used in ordinary practice in driving from engines, so that the conditions are practically identical with those in actual use. WM. O. WEBBER.

[We obviously cannot reproduce the blue print of our correspondent in a way to show the effects spoken of. The crayon shading and the stamped lettering should be serviceable devices, and show well in the blue print.—ED.]

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## Just a Few Objections to Lathes.

Editor American Machinist:

Being but an ordinary, greasy machinist (and I might add modestly a toolmaker), I do not feel competent to offer any very valuable suggestions to the modern machine tool designers, but I would like to object to a few of the most radical monstrosities—a few of those neglected points about machine shop tools that lead a machinist to nervous prostration.

First, to my mind comes that overhead cone pulley on the countershaft, with no flange on the small step to keep the belt from running or falling off and mixing up with a protruding set screw in a collar. Of course a man can, by using great care and taking plenty of time, get the belt down from the larger steps to the smallest without its slipping off, but if he happens to be on a job that the foreman wants in a hurry ("if not quicker") and he forgets how easy that belt runs off, he will lose it every time; then after three or four frantic efforts to replace it, and getting a few pieces of belt dough in his eyes, he quotes a few words softly to himself, while he proceeds to make a tour of search after a pole, finding one after ten minutes or more. The cone pulley without a flange on the small step demands about two columns of your valuable space for its objections, but there are others nearly as bad.

I would like to hold a short interview with the man who makes his lathes with a narrow clamping plate under the tailstock, with two long bolts through, one on each side, and a case of wrench put on and take off. When the nuts are released by a half turn of the wrench on each and a pull given to the spindle hand wheel, that narrow clamp just turns up enough to bind the tailstock, at the same time letting a few chips drop in between the clamp and the lathe bed. The only way yet discovered to move the tailstock back at the first trial is to run the nut up about four turns, which will let the clamp hang clear of all contact with the lathe bed.

For objection number three, we will take that mean little three-quarter or one inch wide carriage feed belt, that after getting slightly greasy will slip, and, if made tight, will tear out at the lace holes. Of course, we know that there are a few of the latest designed lathes that have discarded the belt for driving the feed spindle, replacing it with gears with quick changes of feed. These last mentioned are only a fond dream to most of us, seen only in the windows of large dealers, or in half-tone effects in the advertising pages of your valuable paper.

"I think I can see" a "manager" replacing a lathe that is in any kind of working order for a new machine. If he should want a new lathe, he would probably get a slightly lower price on the old style lathe, and the thought is too often far from his mind of consulting the shop foreman, who reads the "American Machinist," looks over all the latest catalogs, and knows exactly where those few extra dollars in the price of the latest improved lathe would be saved before the paint would get soiled on it.

D. E. MACCARTHY.

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The "American Machinist" passed its twenty-first birthday last month, and is now old enough to vote.

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## Education of Naval Constructors.

Recently a board of naval officers has been appointed to devise a post-graduate course of instruction for young naval constructors. The course is to be pursued at the United States Naval Academy.

It is safe to say that the publication of this bit of information will start warm discussions on board of every naval vessel and at every naval shore station; for the work of the naval constructor is of such far-reaching character, and the interests of all officers of every corps are so vitally affected by the constructor's output, that criticism of various details of naval construction and of ships as complete fighting structures is a matter of daily occurrence among naval officers throughout the world.

There need be but little wonder, then, that the method of recruiting the construction corps of the navy should be a matter of widespread interest in the navy itself. A naval officer, who is opposed to the present plan of recruiting the corps, gives the following terse summary of the plan: They take a couple of naval cadets who in their four year course at the Naval Academy have manifested unusual aptitude in mathematics, send them to an institution either at home or abroad, and stuff more mathematics into them, and then—they label them naval constructors!

If naval construction is anything at all it is surely as much of an art as it is a science. Its problems are chiefly practical. More than 99 per cent. of the mathematical work met with in the career of the average naval constructor is within the easy grasp of the Naval Academy graduate. What the candidate for the grade of assistant naval constructor needs above all things is an intimate practical knowledge of a ship as she is used—a ship in actual cruising service.

Fortunately there are many such candidates right at hand; young men who, as ensigns or as assistant engineers, know a ship from stem to stern, who know her peculiarities in all weathers, who know a thousand facts about her good qualities and her bad ones, who have crawled through her boilers and her double bottoms, who have stumbled along her labyrinthian passages when the electric lights went out, who have seen ingenious repairs made at sea in stress of weather, who have commanded men on deck and below decks, in boats and aloft, who have superintended the cleaning of bilges and compartments, the working of watertight doors, the manipulation of manifolds, pumps, fire apparatus, signal gear, ammunition hoists, gun gear, torpedoes, the stowage of coal and what not—in short, we have constantly within call some hundreds of young men who have lived the naval life and who must possess among their number a few individuals that would, if given an opportunity, make excellent naval constructors.

Our plan would be to fill vacancies in the grade of assistant naval constructor in the navy by appointing to that grade officers selected from the grades of assistant engineer and ensign. No examination should be required; the appointments should be made solely upon the manifest fitness of the candidates, as attested by the letters of the superior officers with whom they may have sailed.

The candidates should be not less than twenty-eight or more than thirty-one years of age and should have at least five years' sea service.

Immediately after appointment the young constructors should attend special lectures for about six months. After that their natural aptitude and personal pride, coupled with a fruitful, early practical training, may be trusted to make of them naval constructors inferior to none.

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## The Factor of Safety in Machine Design.

In the design of a bridge, a roof or a warehouse floor, the ability of the structure to carry the load is the chief requirement, and to insure that it shall do this with safety, even under accidental strains, a factor of safety is introduced; and although the name has been often criticised, it nevertheless represents with a fair degree of accuracy the state of the designer's mind in making the calculations.

In treatises on machine design the same term is used to express the ratio between the actual working strain and the strain which would produce rupture, although there is and can be no such conception in the machine designer's mind in making the calculations. In such parts, for instance, as connecting rod bolts, straps and keys, the strains under the working loads will often be found to run down to 3,000 pounds per square inch, while in engine frames the strains seldom exceed 500 pounds, and will frequently run down to 300 pounds per square inch. With steel of 60,000 pounds tensile strength, the figure for connecting rod parts is equivalent to a factor of safety of 20, while for engine frames, cast iron being assumed to have 20,000 pounds tensile strength, this goes up to 40 and 70 for the two strains named. Now, it is certain that no designer of such parts has any conception of a factor of safety, as that term is commonly understood, in his mind when he proportions these parts for such strains, and the term "factor of safety" in this connection is simply absurd.

The purpose of the designer in introducing these low strains is not to provide a surplus of strength for accidental strains, but to provide such a degree of stiffness that the parts will not yield unduly under the regular loads of everyday work. He has, in fact, very little thought of strength in the sense of ability to resist rupture, his whole thought being to make the structure so rigid that the deflection under the working load shall be inappreciable, or at any rate so small as to do no harm. From this point of view the great surplus of strength is rational and understandable, while from the factor of safety standpoint it could not be defended.

A strictly scientific method of machine design would base the dimensions on the formulas for deflection rather than on those for the ultimate strength of the parts. In using the formulas for strength as he does, the designer practically converts them, in a rough and ready way, into formulas for stiffness, which is but the reciprocal for deflection, and, so far as methods go, this is probably as far as we shall ever get or as it is practicable to get in most cases. That the allowable deflections under any considerable number of the infinite variety of conditions prevailing in machine construction will ever be be determined is not to be expected. It is, however, quite time that the use of the term factor of safety was discontinued in relation to machine construction, and there can scarcely be a more effective method of calling attention to the fundamental error of thought

involved in its use than a presentation of the idea of stiffness present in the designer's mind in his determination of dimensions.

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We have referred to the matter of department stores, to the attempts to restrict their business by hostile legislation, and to the fact that these stores are doing in commercial matters nothing else than what has been done regularly in manufacturing for years. That is to say, by organizing a large business and conducting it with that end in view they economize in expenses and are able to sell cheaper than is possible by less efficient methods. This is not open to the objections of a monopoly, and their competition can be met only by adopting some of their methods. A dealer in machinists' supplies in New York meets them in just that way, and showed us the advertisement of a large department store in New York, illustrating and quoting prices on tools also handled by him. These prices were in many cases higher than his regular quotations, and in no case materially lower. This not only shows that merchants who make a specialty of one line may possibly meet the competition of the department stores by recognizing actual conditions and conforming to them, but it illustrates the fact, well understood by the initiated, that prices quoted as phenomenally low may not be at all remarkable as a matter of fact when compared with best current quotations in the trade. Merely because prices are quoted by a department store or by an establishment which often or generally quotes low prices is no guarantee that any specific quotation is low.

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The American Emery Wheel Works, of Providence, R. I., recently made and delivered an emery wheel of interesting proportions. This wheel measured 48½ inches in thickness and weighed 400 pounds. It was made to run at a speed of 1,600 revolutions per minute, and 40 pounds of lead were used in pouring the bushing. This is stated to be the thickest emery wheel on record, and it was designed for cleaning hides.

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It is found that the ventilation of the new subway in Boston presents some special problems, it being desirable not only to secure pure air, but also to prevent an accumulation of moisture. Recently special motor-driven fans have been installed by the B. F. Sturtevant Company, of Boston, which are of the cone type, two of them 7 feet in diameter and the others 8 feet in diameter. They have a capacity when running together to change the air in that portion of the subway with which they connect once in fifteen minutes.

In the recent trial in France of automobile vehicles for carrying goods it seemed to be proved quite conclusively that, however satisfactory the oil motor may be for light vehicles, steam is more suitable for wagons of 2 tons and over, and oil is the best fuel for these. The most efficient wagon tried ran its 40 miles with 6½ gallons of oil and 40 gallons of water, or about two-thirds of a gallon of oil per horse-power for the whole distance.

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An accident which recently occurred upon an English railway was attributed to the shifting of a wheel upon an axle of one of the cars. The locomotive superintendent of the Great Western Railway, upon which the accident occurred, proposes hereafter when wheels are pressed on to apply a reverse pressure of 50 tons, so that wheels not sufficiently tight may be detected.

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## Questions and Answers.

**Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.**

(114) S. T., Moline, Ill., writes: (1) A says that in threading pipe taps the threads should be cut square with the taper, and B says they should be cut square with the center line of the tap. Which is right? A.—B is right. (2) I send a sketch of work that is to be turned in a lathe. It is ¼ inch diameter, 10 inches long, of tool steel, and is to be turned to 3-16 inch diameter. What is the best way of doing it, and what kind of tools should be used? A.—The best way of doing such work if any great accuracy is required is to turn it approximately to size and true by use of a follow rest and any kind of a suitable tool which the lathesman may prefer. Then it should be finished in a grinder. If a grinder is not available for the work, however, it must then be finished by a second or third cut in the lathe, and, if necessary, also by filing.

(115) A. M., Little Falls, N. Y., asks for the comparative pressure on the thrust bearing of a steamship when the ship is in motion and when tied up at the dock. A.—Seaton's formula for the thrust is as follows:

$$P = I\,H\,P \times \frac{217}{K}$$

in which
$P$ = the pressure in pounds,
$K$ = the speed of the ship in knots per hour.

In interpreting this formula the speed of the ship is to be understood as the speed through the water and not past a stationary object on shore. If taken as the absolute speed, the value of $P$ would of course be infinite when the ship is tied up, which is obviously impossible. When the ship is tied up the power of the engine is expended in setting up a current of water past the ship, the speed of which must be known in order to apply the formula. The value of this would obviously depend on circumstances, a boat moored in midstream, for example, being under very different conditions, in this respect, from one tied up in a ferry slip, and what average values would be we have no means of knowing.

(116) R. C. R., Kingston, N. Y., asks (1) for a formula for the strength of a steam chest having the cover cast in one with the sides. A. There is probably no class of problems relating to the strength of materials regarding which existing knowledge is so unsatisfactory as the one to which this inquiry belongs. The most recent experiments and the ones leading to the most definite conclusions are those of Professor Bach, an abstract of which was published in our issue for February 17 last. This investigation, however, related to round heads and would not furnish a satisfactory guide for rectangular ones. Much mathematical ingenuity and ability have been expended in analyzing the strains involved in such pieces, but very few experiments have been made to test the correctness of the resulting formulas. In the absence of such experiments, and in view of the complexities and uncertainties of the strains and of the differences between the different formulas, they should be considered as rough guides only. (2) How much pressure could a 30-inch piston driven by 100 pounds of steam exert if there was no outlet for the exhaust? A.—Disregarding the momentum of the parts, the piston would come to a standstill as soon as the pressure on its two sides was equal—the area of the two sides being assumed to be the same.

(117) E. B., Elmira, N. Y., asks whether the rim or hub brake as applied to a bicycle produces the greater strain on the spokes. A.—We do not think an exact analysis of the strain per spoke can be made, though it is easy to see that the total load is greater with the hub brake, as in this case the effect is a turning effort on the wheel the same as that due to driving the machine, though in the opposite direction, the inertia effect of the machine and rider being, however, multiplied at the hub by the ratio between the diameters of the wheel and the brake surface. With tangent spokes the strain is of course borne equally by all the spokes leading in one direction; that is, by one-half the total number of spokes. With the rim brake, as ordinarily placed, the effect of applying the brake is to put a bending strain on the wheel as a whole, the wheel being in the condition of a beam supported at both ends and loaded in the middle, the load being equal to the inertia effect without multiplication. The strain on the spokes is essentially the same as that due to the load on the machine when being ridden. Such a load on a wheel with tension spokes is well known to be divided among all the spokes of both systems except a few near the point where the load is applied. Nearly twice as many spokes will thus be seen to carry the load in the case of a rim brake as in the case of a hub brake, but the total strain is more than doubled with the hub brake. The strain per stroke is thus greater with the hub brake, but how much greater it is impossible to say, as the number of spokes which do not assist in carrying the load on a tension spoke wheel is uncertain.

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"Maud says she is madly in love with her new wheel." "Huh! Another case where man is displaced by machinery."—Household Words.

## An Improved Reversible Throttle Valve.

The drawings show a reversible throttle valve, invented by Mr. A. K. Mansfield, mechanical engineer of the Buckeye Engine Company, and used upon the engines of that build and elsewhere. The reversibility of the valve is in the fact that merely by bolting together in different positions the inlet and outlet pipes may be straight with each other, as in Fig. 1, or at a right angle as in Fig. 2, the position of the operating spindle and the outlet and inlet are obtained by the different relative positions in which the two portions of the valve are bolted together. The circular valve seat is an integral part of one of these main castings. This valve seat has two large steam openings with radial outlines embracing sufficiently less than a quarter of a circle to give a good lap to the valve when closed. A central stud is screwed into the valve seat, and upon this the valve turns. The valve has openings through it corresponding to those in the seat, and when the valve is fully open these openings coincide, while by turning the valve 90 degrees the openings are completely closed. The valve is, of course, held upon the seat by the steam pressure, but a spring

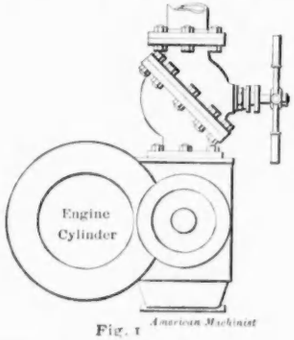


Fig. 1

A REVERSIBLE THROTTLE VALVE.

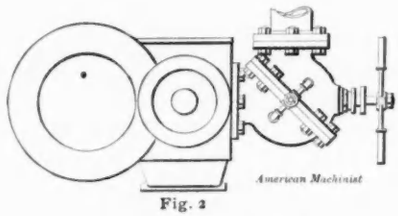


Fig. 2

THE PIPE REVERSED.

grees to the valve face, has on its inner end a pinion of 12 teeth engaging with the teeth on the back of the valve, and one rotation of the spindle moves the valve from wide open to shut or vice versa. Stop lugs are provided on the back of the valve and on the spindle case, which prevent the valve from traveling beyond its proper limits. The valve possesses, as will be seen, besides its ready change of angle, the further important features of being quick-opening and also of giving a very free passage for the steam. A by-pass, as shown in Fig. 2, is sometimes used upon the larger valves when the pressure also is high and the valve may start hard.

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## American Foundrymen's Association's Standardized Drillings.

The committee appointed by the American Foundrymen's Association to establish and advance a national bureau for the distribution of uniform standardized drillings is now able to distribute a range of samples for managers and chemists making or using pig iron.

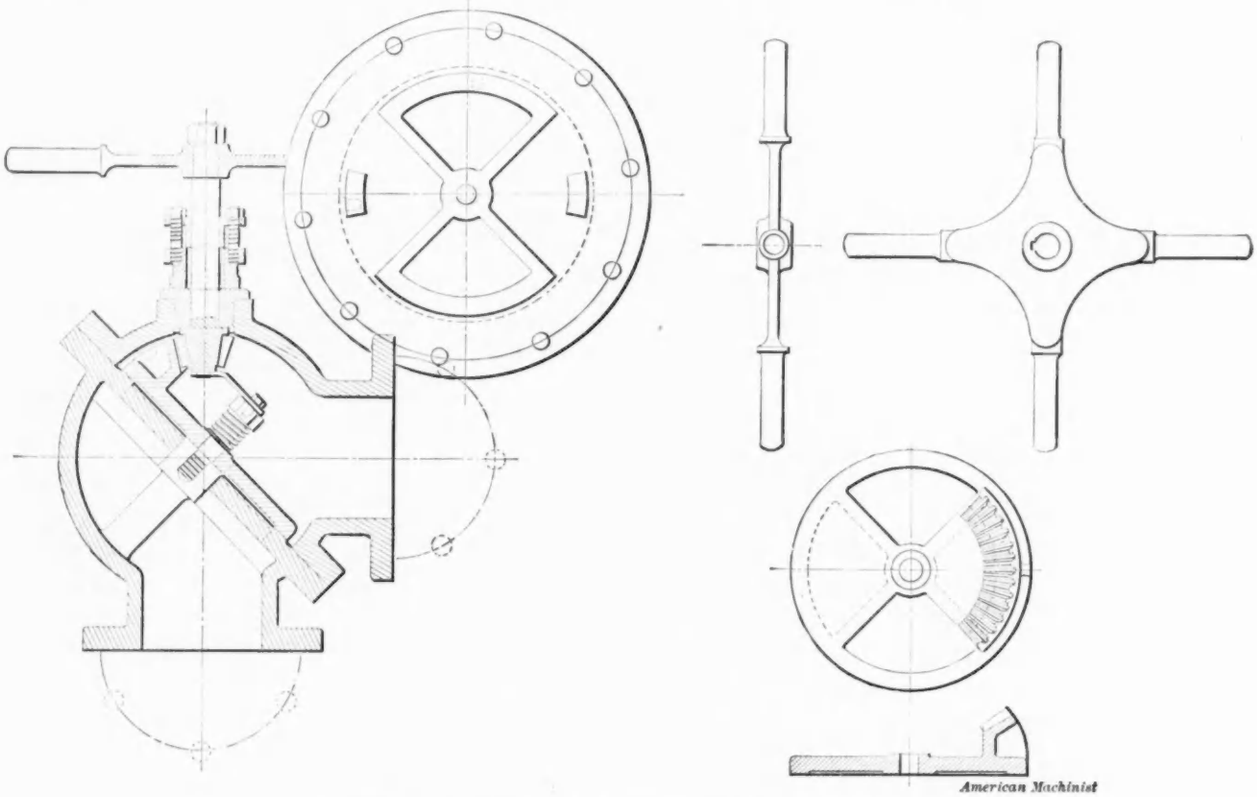


FIG. 3.—DETAILS OF REVERSIBLE THROTTLE VALVE.

cross handles remaining in either case the same.

The construction of the valve is clearly shown in the shop drawing, Fig. 3. The main castings of the valve have each a face at an angle of 45 degrees to its axis, and the different relative angles of

is provided upon the central stud to insure that it will never leave the seat. Upon the back of the valve is a portion of a bevel gear sufficient for the movement required, 14 teeth being used out of a complete circle of 50 teeth. The operating spindle of the valve, at 45 de-

The standardized samples now ready for distribution cover the following determinations:

Silicon, one each of a low, medium and high range of cast iron.

Sulphur, one each of a low, medium and high range of cast iron.

Manganese, one each of a low, medium and high range of cast iron.

Phosphorus, one each of a low, medium and high range of cast iron.

Total carbon, one determination.

Graphite, one determination.

Titanium, three determinations.

In all, seventeen determinations made on four samples.

The samples are designated as A, B, C and D. Sample A, which has been ground to pass a 40-mesh sieve, gives one total carbon and one graphite. Sample B gives a low silicon, a medium sulphur, a low manganese, a phosphorus which is within the Bessemer limit, and a titanium. This has been passed through a 20-mesh sieve. Sample C gives a medium silicon, high sulphur, medium manganese, medium phosphorus and a titanium. This has also passed a 20-mesh sieve. Sample D gives a high silicon, low sulphur, high manganese, high phosphorus and a titanium, and has passed through a 40-mesh sieve.

The drillings are obtained from castings made after the plan described by Mr. West in his paper before the Pittsburg Foundrymen's Association, June, 1898.

The standards are sold at the price of $5 per pound, and in no instance will less than 1 pound be sold. The samples are packed in bottles, holding one-third of a pound, and delivered in cases, holding three or four bottles, according to the desires of a subscriber. One bottle each of samples A, B, C and D can be had, or a subscriber can have three or four bottles of all one sample (excepting the sample A, which contains the total carbon and graphite, and of which only one bottle will go to any one subscriber), or two or three bottles of one sample and one of another; in fact, bottles of samples B, C and D can be sent in any proportion desired. One pound of the samples should furnish enough material for thirty-six complete analyses, or at least 200 separate determinations. The analyses of the samples A, B, C and D will be sent separately by mail, so that they may be placed upon bottles or kept private, as desired by the subscriber.

The amount asked for these standards, considering their cost, is very low, and the drillings such that no chemist could manufacture them for himself at many times the price. The outlay for preparing the four samples was somewhat over $400.

Those wishing to order standardized samples can address their orders to any of the following committee and they will be forwarded at once: Thomas D. West, chairman, Sharpsville, Pa.; Dr. R. Moldenke, Forty-eighth street and A. V. Railway, Pittsburg, Pa.; James Scott, Lucy Furnace, Pittsburg, Pa.; P. W. Gates, Gates Iron Works, Chicago, Ill., and E. H. Putnam, "The Foundry," Detroit, Mich.

## Personal.

Our occasional contributor Joseph A. Rothwell, who was recently placed in charge of all machine tools at the Pioneer Iron Works, Brooklyn, New York, has been appointed to take charge of the entire machine shop.

Norman A. Hartley, for some years chief machinist in the Government Printing Bureau, Ottawa, Ont., has resigned to accept a position as mechanical superintendent with the "Herald" Publishing Company, Halifax, N. S.

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## Obituary.

W. M. Wilson, vice-president of the American Steel Casting Company, Chester, Pa., died in this city November 18.

Passed Assistant Engineer F. H. Conant, U. S. N., died recently at Annapolis, Md. He entered the Naval Academy in 1878, graduating in 1882, became assistant engineer July 1, 1884, and passed assistant engineer September, 1894.

P. P. Mast, of Springfield, Ohio, died in that city November 20, seventy-three years old. He was the head and principal stockholder in a number of manufacturing corporations, of which were P. P. Mast & Co., builders of grain drills; Mast, Foos & Co., builders of windmills, engines, etc.; P. P. Mast Buggy Company, besides a great number of other companies of all kinds, his estate amounting to several millions of dollars.

Franklin Gardner died at Carlisle, Pa., November 18, seventy-eight years old. Mr. Gardner was born in York County, Pa., and went to Carlisle in 1840 to work in a small machine and repair shop. The next year he started a business of his own, his shop being driven by horse-power. A year or two later he built the first steam engine seen in the Cumberland Valley. His business grew rapidly and developed into a large car building concern, which in 1880 was sold to the Carlisle Manufacturing Company. In 1883 Mr. Gardner, with his sons, went into the axle business, and two years ago he retired.

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## An Alloy With a Very Small Coefficient of Expansion.

An account of a new alloy of nickel and steel was laid before the International Geodetic Association at its Stuttgart conference. The International Bureau of Weights and Measures at Paris has found that when a bar consists of 36 per cent. nickel and 64 per cent. steel, the expansion from heat is only 1-50 of what we should expect from the individual components. This discovery has great importance in the construction of clocks, especially astronomical clocks, since the effect will be practically to eliminate the temperature question, which has thus far been the great difficulty in obtaining a uniform rate in timepieces.

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## Voting Machines.

It is admitted that the use of voting machines in the city of Rochester at the recent election was a complete success. The full vote of the city was known long in advance of that of any other city in the State, and there have been no complaints about the working of the machines and no question as to their accuracy. In addition to these facts, it is shown also that there is a large saving in expense over the ordinary election system. The number of election districts was reduced more than one-fifth, making a large saving in rentals, the services of a large number of ballot clerks were dispensed with, the printing expenses were greatly cut down, making a total saving in all of over $5,000 annually. It is shown that the machines will pay for themselves in this way in six or seven years, and that from that time forward the cost of elections will be comparatively slight. Of course, the greatest advantage of the system lies in the complete inability of anybody to alter the count. Both regular voting and independent voting are recorded with absolute accuracy the moment they take place. Then, too, there can be no trace left anywhere of the way in which the voter has expressed his will, since there are no ballots to mark. There are also no defective ballots either, for an elector can vote only in such a way as to have his vote counted.—New York Evening Post.

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## A Wonderful Pumping Engine.

An Allis pumping engine has recently been installed at Cleveland, Ohio, and a reader and friend of the "American Machinist" has forwarded an alleged description clipped from a local paper. We can spare space only for the following extract, which our readers will doubtless appreciate:

"The engine is supplied with three cylinders, 34 inches low, and has a 60-inch stroke, and is able to pump 20,000 gallons of water every 24 hours at 181½ revolutions per minute under 150 pounds steam pressure. It is operated by three fly-wheels of 20 tons each, and measuring 20 feet in diameter apiece. The shaft is 18 inches, and crank and shaft weigh 28 tons. It is supplied by a Corliss & Popet valve movement, and has 1,435 3½ inch water valves. It is operated by two Gerry water tube boilers, 16 feet long, containing 123 4-inch flues, each heated by either steam, electricity or gas."

# Commercial Review.

NEW YORK, SATURDAY EVENING, November 26 1898.

THE MACHINE TOOL MARKET.

Trade centering in New York is excellent. The month of November has brought a perceptible increase to the demand for metal-working machinery. Signs of activity need no longer be sought in the out-of-town manufactories. They are now manifest right here in New York selling offices. The cause of the improvement may be traced by some to the passing of the election, but we are rather inclined to think that it is due to general growth of national prosperity. A great deal of the activity of trade has probably come from the successful termination of the war, and has been all the surer because it did not sweep down with a rush immediately after the signing of the protocol. The triumph of the policy of imperialism also has created a buoyant feeling of confidence in the country, the reasonableness of which it is not our place here to consider, but merely the fact that since it exists it must be an important business determinant. That the momentum of the machine tool trade is such as to carry it through the holiday period, with only a trifling let-up, there is every reason to hope.

The improvement in business is evidenced by increases in the prices of tools, particularly lathes, which some companies are now making. This is particularly of interest, because it has occurred in medium sized machines, and in the New England territory, where manufactories have been less uniformly busy than in the West. We hear of an advance announced by a Connecticut concern only a day or two ago, a small rise to be sure, but still an increase. Large tools continue to be very active. Heavy lathes and punching and shearing machines are in good demand.

The closing of the Bardwell contracts for tools to build motocycles in France and of a large job let by the Gas Engine & Power Company, New York, in which various tool builders participated, has not left the market void of large prospective purchasers. A certain New York office has three in view within its territory, amounting, we understand it to say, to $60,000 or $70,000 each. All will include a variety of tools. A new machine shop at the steamboat docks of John H. Starin, Port Richmond, S. I., which recently were burned, will, it is said, be constructed, and machinery manufacturers are hoping to put in several thousand dollars' worth of tools. Shipbuilders are reported to be buying tools quite heavily, the names of the Newport News Company and Bath Iron Works being mentioned as purchasers. Railroads are purchasing somewhat, including those in the Middle States. An authority speaks of improvement in the railroad line, yet we do not find that it is particularly noteworthy. There is an inquiry for about $30,000 worth of tools, said to be from a manufacturing company that is busy in building gun carriages. In the Kewanee Manufacturing Company's new factory in Jersey City an equipment of tools, largely of Western purchase, is being installed. This company will be engaged in the manufacture of railway supplies. Typewriter concerns, which have long been quite a feature of the medium sized tool trade, are buying continually. The Underwood Typewriter Company, which is a frequent purchaser in this market, has done some buying of late. The Manhattan and Elliott & Hatch typewriter companies are reported also to have been in the field. It is a question whether the typewriter business is not being overdone, as was the bicycle industry; yet typewriters have the advantage of being a stable and indispensable article, independent of fads. At this season bicycle shops are naturally placing some orders, but no great amount of attention is now given to them. A Pennsylvania manufacturer of bicycle parts recently succeeded in picking up fourteen second-hand automatic screw machines in the Eastern States, which looks as if tools of this class were no longer a scarce article.

The German orders for American machine tools are said to be coming quite heavily from Bremen.

The force employed by the Brown & Sharpe Manufacturing Company was recently stated to be 1,602, a greater number than at any previous time.

WOOD-WORKING MACHINERY.

While this is never an active line of trade in the East, there are signs that of late it has improved to some extent. The number of small sales and the inquiry are fair, and November seems generally to have run ahead of October. Two sales of importance were made this week by the Berlin Machine Works to planing mills in Pennsylvania and in New York. The South has been dull for some time, the depressing influences being threefold—collections, the election and yellow fever. There is at least one report, however, of improvement in that section. Whatever the East and South may be in regard to demand for wood-working machinery, the West, to all accounts, goes far to redeem the country.

For car building machinery the demand in this territory is only moderate. The S. A. Woods Company, Boston, is said to be busy in its car machinery department, which may be partly attributable to peculiar causes—the acquisition of certain patents. Some good inquiries for this class of machinery are in the field, but these are nothing unusual. One prospective source of business is a new shop that the Lehigh Valley Railroad is erecting, where it is said a wood-working outfit will be needed.

Prices of wood-working machinery in certain quarters are weak and cuts are made. It is not to be supposed, however, that concessions are obtainable from those companies which are busy.

MISCELLANEOUS.

The T. & B. Company, of Danbury, Conn., manufacturer of twist drills, has been bought out by the Morse Twist Drill & Machine Company, of New Bedford.

Ben. F. Lamborn, city clerk, Alameda, Cal., with a view to the preparation of specifications for bids, desires catalogs or other information concerning electric lighting and electric railway equipment, construction, cost, etc., with any available data relating to the results given by machines of various types in electrical power plants.

The Philadelphia Bridge Works are said to have secured an order for two 60-ton turntables for the Chihuahua & Pacific Railroad, Mexico.

CHICAGO MACHINERY MARKET.

Last week the United States arsenal at Rock Island, Ill., opened bids for fifteen iron-working machines and for seven wood-working machines. This supplements considerable previous buying. In all, this arsenal has this year expended from $75,000 to $100,000 for new machinery equipment. It is an illustration of the new work which the Government will furnish the toolmakers, the good effects to be felt by the machine trade generally. The scale of work will be maintained on a much more extended basis than before the late unpleasantness with Spain. Territory as far West as Chicago will share in the benefits.

Stocks of machine tools at Chicago are scantier than a month or two ago. This is not due wholly or chiefly to large demand, for the bulk of trade moves directly from maker to consumer, the machines in store here being mainly used as samples. But because of the inability of manufacturers to make prompt shipments, selling agencies here have permitted tools to be taken from their stocks. One or two houses, which early in the autumn anticipated a heavy demand and stocked up proportionately, have been disappointed somewhat in the volume of business, but nevertheless the oversold condition of the makers has so interfered with shipments that drafts on the stocks were compulsory. A larger percentage of trade than anticipated came from store and a smaller from factory.

The machine trade for November has been about equal to that for October. For the first two weeks of this month buying was scant, but the month finished with greater activity. There has been fair buying by the implement makers.

The bicycle trade is indifferent. Several large works have started up within a week or two, but the middle class of makers seem to be drifting out of business. Several good sized shop equipments have come into the market from bicycle works that have suspended operations. Among the larger makers the diversified markets of the world are permitting continuous activity throughout the year, and one or two of the largest local plants are still producing 1898 wheels for the South American trade. Others have commenced on the 1899 patterns. But if there be on the whole a declension in the bicycle trade it is more than offset by activity in the carriage line.

For wood-working machines inquiry is improving. The prospective purchasers, in many instances, are deferring contracts until after the opening of the new year; but they say that when they get ready to buy they want little delay in shipping the tools. In the inquiries for iron-working machinery the question of deliveries is more generally canvassed.

The Pratt & Whitney Company has made an unusually large number of sales among the agricultural implement works during the past month.

McDowell, Stocker & Co. have just purchased the entire equipment of the National Electric Company, of Eau Claire, Wis., which has retired from business.

PITTSBURG REPORT.

On all sides can be heard reports of increased business, chiefly from the raw iron and steel manufacturers, who have their plants running to full capacity and on long hours. The Carnegie Steel Company, Limited, keeps its Homestead Steel Works, Edgar Thompson Works at Braddock, and the Duquesne Steel Works going as fast as possible. The output of these combined plants is larger to-day than ever before, and many improvements are in contemplation looking to the further increase of production. This company produces, on an average, about three-fifths of all the pig iron made in the Pittsburg district, and it is now stated that two more furnaces are to be built for its Carrie Furnace plant at Rankin Station.

All the other large steel works of the country report the same degree of activity. Jones & Laughlin are running their immense plant to full capacity, and intend making additions to the cold rolled shafting and machine departments. Two new Morgan continuous mills are to be installed in the near future. These will add largely to the output of the works. All the Westinghouse interests are very busy. The works at East Pittsburg and Wilmerding are filled with work and the outlook is very promising for a continuation of a busy season.

The heavy mill machinery market is taking on a better appearance. A little surprise was occasioned last week when word was given out that the Leechburg Foundry & Machine Company and the Robinson-Rea Manufacturing Company had consolidated their interests. The former concern had carried on a heavy trade in the Mesta patent pickling machine and tin plate rolls, shears, etc., while the Robinson concern had done much of the latter class of work, in connection with rolling mill castings, etc.

At the present time contracts for work on the new Shoenberger rod mill and the Avonmore tin plate plant are pending. In all probability the work will be given out in a week or so. Mr. Samuel Diescher, Hamilton Building, Pittsburg, has charge of the Alcania works at Avonmore.

The smaller plants, including the foundries and machine shops, are fairly well filled with orders and are enjoying a little better prices than were usually obtainable some few months ago. More iron is being melted now than for some time past, and there seems to be general rejoicing throughout this line of trade.

Dealers in mill supplies are now beginning to enter into their semi-annual season of activity. A short time before and around the holidays most of the mills and factories shut down for a period of several weeks to make general repairs. This season is coming on rapidly, and the

*(Continued on page 42.)*


## Business Specials.

**Gear wheels, gear cutting, Grant; see page 20.**

**Forming Lathes. Mer. Mach. Tool Co. Meriden, Conn.**

**Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.**

**For rent, with power, whole or part manufacturing building, four floors, 110 x 35. P. O. Box 886, New Haven, Conn.**

**Export to Europe—General agency for own account for sale of machine tools and hardware wanted by Neumann & Boeler, Hamburg, Germany.**

**For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.**

**A manufacturing concern having large shops with modern tools, foundry, pattern shop, etc., is desirous of adding to its present line, and wishes to negotiate with parties wanting mach'y built. Box 36 Am. Ma.**

**Complete set American Machinists, 1877 to 1898, for sale; first 18 vols. bound in morocco, uniform in style (binding alone cost $4.75 per vol.); 1898 vol. 19 in cloth; 1897 vol. 20 includes advertising, and is in leather; 19 volumes have name of private individual on side; will sell the twenty volumes complete for $100. Address Volumes, care American Machinist.**


## Wants.

*Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.*

### Situations Wanted.

**Foundry foreman of exp. wants position in machinery or jobbing shop. Address Box 135, Am. Mach.**

**Draftsman, 10 years' exp. on steam engines, pumps, gen. mach., wants pos. as salesman, mach. shop foreman's assistant, timekeeper. Box 133, Am. Machinist.**

**Wanted—Position as foreman; had experience on small tools, model gauge, die and small machinery; smaller the better; good reference Box 89, Am. Mach.**

**Young man, fair machinist, experienced draftsman, technical education, desires position with chance to rise; hydraulic or comp'd air pref'd. Bx. 139, Am. Mach.**

**An experienced machinist and draftsman desires a position as foreman or master mechanic; is used to managing men and can furnish best of references. Box 94, American Machinist.**

**A successful mechanical supt. is open to engagement; a first-class manager up in modern shop practice on economical production of work; correct habits and reliable. Box 126, American Machinist.**

**A married man would like position as foreman or supt. of electrical works or plant; holding same pos. now; good designer of electrical machines and apparatus; has a thorough mechanical knowledge; can get work out very cheap; good salesman; a hustler; good reasons for wanting to change; good reference. Box 129 American Machinist.**

### Help Wanted.

**Wanted—Mechanical draftsman accustomed to engine work; state experience and salary. Foos Gas Engine Co., Springfield, Ohio.**

**Wanted—Three first-class die makers on cutting, drawing and forming dies for sheet metal. Address Box 137, care of American Machinist.**

**Wanted—First-class machinist familiar with pump work, to take charge of small pump shop as a working foreman. Box 114, American Machinist.**

**Wanted—Draftsman who has had exp. in designing presses, drop hammers and spec. mach., and who can take charge as supt. Box 128, American Machinist.**

**Wanted—Salesman to travel; one understanding presses and capable of estimating on dies and special machinery preferred. Box 127, American Machinist.**

**Manufacturer of Shift Case typewriter wants supt.; must have successfully filled such a position and know thoroughly all details. Address, giving experience, Box 132, American Machinist.**

**Wanted—A thoroughly experienced designer and draftsman who has had extensive practice on large Corliss engines and marine engines. Address, with references and full particulars, Box 452, Pittsburg, Pa.**

**Wanted—Good business man to take charge of branch office, New York city; knowledge of mechanics and willing to invest $5,000; business established and increasing; sales this year $40,000. Box 138, Am. Mach.**

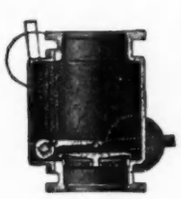
**Wanted—Foreman for room running 30 punch presses and 15 screw machines on piece work; must be thoroughly posted on best practice with these tools. Address, giving experience, Box 131, Am Mach.**

**A concern building a complete line of punch presses of the highest class desires a foreman; applicant must be a thorough and practical mechanic, capable of obtaining the best results from the men in his charge. Address Box 136, American Machinist.**

**Wanted—Boiler shop manager and supt.; one who is thoroughly competent to take charge of a shop employing from 30 to 60 men; is expected to handle sales, estimates, etc; in applying state exp., refs. and salary expected, also how soon could begin work if engaged. Address Box 125, American Machinist.**


**THE MECHANICAL ENGINEER'S POCKET-BOOK.** Fourth Edition, Revised. Now Ready.

A Reference Book of Rules, Tables, Data and Formulæ for the Use of Engineers, Mechanics and Students. By William Kent, A.M., M.E., Consulting Engineer, Member Amer. Soc'y Mechl. Engrs. and Amer. Inst. Mining Engrs. 12mo. Morocco. Upward of 1,100 pages. $5.00. Order through your bookseller, or copies will be forwarded postpaid by the publishers on the receipt of the retail price. **JOHN WILEY & SONS, 53 East 10th Street, New York City.**



**Excelsior Straight-Way Back Pressure Valve.** This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

**JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.**

(*Continued from page 41.*)

dealers are beginning to book orders for odds and ends of jobs and frequently large amounts of goods.

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## Quotations.

NEW YORK, Monday, Nov. 28.

Iron—American pig, tidewater delivery:

| | |
|---|---|
| No. 1 foundry, Northern | $11 25 @ 11 50 |
| No. 2 foundry, Northern | 10 75 @ 11 00 |
| No. 2 plain, Northern | 10 50 @ 10 75 |
| Gray forge, Northern | 10 00 @ 10 25 |
| No. 1 foundry, Southern | 11 25 @ 11 50 |
| No. 2 foundry, Southern | 11 00 @ 11 25 |
| No. 3 foundry, Southern | 10 50 @ 10 75 |
| No. 1 soft, Southern | 11 25 @ 11 50 |
| No. 2 soft, Southern | 11 00 @ 11 25 |
| Foundry forge, Southern | 10 00 @ 10 25 |

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.55c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.25 and upward, according to brand and quantity. A ruling figure for moderate amounts is 2.31c.

Copper—Carload lots, Lake Superior ingot, 13c.; electrolytic, 12.65 @ 12.75c.; casting copper, 12.60@12.70c.

Pig Lead—Carload lots, 3.67½c., f. o. b., New York.

Pig Tin—For 5 and 10 ton lots, 18.60 @ 18.75c., f. o. b.

Spelter—In carload lots, 5.30c., New York delivery.

Antimony—In cask lots: Cookson's, 9½c.; Hallett's, Japanese and French E. B., 8¾c.; United States, 8.70@ 8.75c.; some Cookson's is selling in large quantities at 9⅛c.

Lard Oil—Prime city, present make, 44 @ 46c. for the leading brand in wholesale lots.

▲ ▲ ▲

# Manufacturers.

At Chicago, Ill., the Competition Woolen Mill has been incorporated and will purchase new machinery.

An addition is being made to the Charles Fletcher No. 1 Mill, at Blackstone, Mass. The buildings will be equipped with new machinery.

The Tamaqua (Pa.) Manufacturing Company has started to enlarge its factory. It will take 6,000 square feet of roofing to cover the plant.

The directors of the Carr-Lowrey Glass Company, whose works burned down recently at Westport, Md., have decided to rebuild the plant at once.

Increasing business at the Fiberloid Works, Newburyport, Mass., necessitates an addition to the plant and an increase of boiler capacity, which will soon be made.

The Island Paper Company, of Carthage, N. Y., has been incorporated to manufacture paper. Capital, $60,000, and directors A. E. Maxwell, of Carthage, and two others.

The shipyard of John H. Starin at Port Richmond, N. Y., was recently almost totally destroyed by fire. The machine shop was completely gutted. It is not yet known whether the shops will be rebuilt or not.

The J. K. Lamb Textile Company has been formed in Camden, N. J., with a capital of $10,000. The incorporators are Joshua K. Lamb and Henry Lamb, who will receive bids for the necessary new machinery for the mill.

Extensive improvements and alterations are to be made at the Edgar Thomson Steel Works of the Carnegie Steel Company. New blowing engines will be installed and other changes will be made which will increase the plant's output about one-third.

In a recent issue we stated that the Wilfred Eames Company had moved from one location in Rochester, N. Y., to another in the same city. This was an error, the company referred to having moved from Cleveland, Ohio, to Rochester, N. Y.

The Westinghouse Electric Company has begun work on a new building at the shops at East

# Help Wanted—Continued.

Wanted—A large manufacturing plant in the iron line (working about 500 men), about to locate in Chicago, wishes to engage a supt. and foreman for each d'p'tm't, viz., forge shop, mach. shop, wood shop, paint shop and eng'ring d'p'tm't; replies cannot be too specific in all points. Ad. Lock Box 1184, Chicago, Ill.

# Miscellaneous Wants.

*Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Caliper catalog free. E. G. Smith, Columbia, Pa.

Bock, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Wanted—The best battery for gas engine purposes. Address BOX 130, AMERICAN MACHINIST.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Rim gear wheel milling machine; also cam milling machine, second-hand, if in first-class condition. Address BOX 98, AMERICAN MACHINIST

For Sale—A well equipped foundry making a specialty near New York. Address Foundry, care of A. A. Cardwell, 39 Cortlandt street, New York city.

The undersigned wishes to correspond with thoro' Eastern mach. works relative to the building of some steam eng.; requires 30 ft. under crane. BX. 100, AM. MA.

Engineers and firemen, send 10 cents for a 24-page pamphlet containing a list of questions asked by an examining board of engineers. George A. Zeller, bookseller, 18 S. Fourth Street, St Louis, Mo.

Wanted—Copies of November 10, 1898, issue. We will extend any subscription in the United States 1 month for a copy in good condition. Send paper with name and address to Subscription Department of AM. MACH.

Wanted—To contract for the manufacture of fifty special machine tools; the advertiser has patterns and drawings; very high-grade work desired; with capacity of turning out at least six machines per month. BOX 95, AMERICAN MACHINIST.

Wanted—To lease in New England or the East an established machine plant suitable for the manufacture of medium and heavy machine tools; give fullest particulars as to plant, naming make of tools and present condition. BOX 96, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

A Belgian eng. who had the management of large establishments and possesses influential connections wishes to represent in Europe mfg. works producing cast iron, steel in blooms, in profile, cons't companies, &c. Address Mr. Lejeune, engineer, Charlerol, Belgium.

An established manufacturing company near New York City wishes to lease its foundry to a practical foundry man; will furnish four to five hund ed dollars' worth of business per month from the start; fine opening for the right man; no agents recognized. Address BOX 56, AMERICAN MACHINIST.


**The CROSS OIL FILTER**

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 120 gals. per day. Used in 18 countries. Testimonials from the leading firms in every field of industry.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.
Business Established 8 Years.
Largest Manufacturers of Oil Filters in the World.

Steel Stamps, Machine Plates, Rubber Stamps.

A. WIEBKING, 603 Mi dred Ave., CHICAGO, ILL.

"TRADE MARK. PEGAMOID" ALUMINUM PAINT.

Latest Application of Aluminum. Looks like Frosted Silver. Washable, Untarnishable. Water, Oil and Weather Proof, Durable. Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors, Apparatus, Arc Lamps, Sockets, Brackets, Cars, Stations, General Decoration, etc. Sample bottle by mail for 25 cents.

AMERICAN PEGAMOID CO., 346 Broadway, New York.

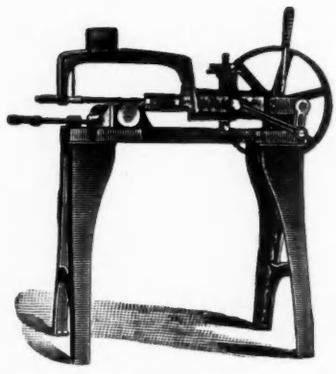
**BARGAINS IN NEW AND SECOND-HAND MACHINERY.**

Lathes, from 12" to 48"; Planers, from 20" up to 60. 48", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6" to 30", Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

FRANK TOOMEY, 131 N. THIRD ST., PHILA.

"The best is as good as any."

The New Automatic and Gravity Feed Q & C Shop Saw



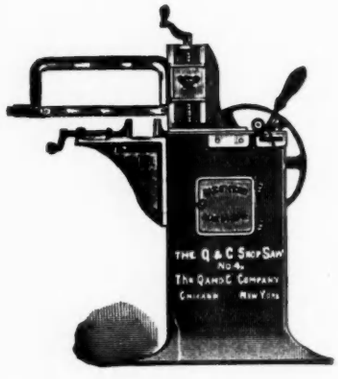
Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.

Quality—'Way up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.




Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Pils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

Pittsburg, Pa. The addition will be 200 feet long and 100 feet wide. It will be used as a general machine shop and will give employment to 100 more hands.

The Union Mills, Wichita, Kan., will have a new building and milling machinery erected. The property which has been purchased is 60 by 140 feet, and will be covered with an elevator and mill. The machinery will be of the very latest in pattern and design.

The Berlin Iron Bridge Company, of East Berlin, Conn., are erecting for the Waterbury Manufacturing Company, Waterbury, Conn., a new blacksmith shop two stories high. The building is to be of fireproof construction throughout. The floor consists of concrete on corrugated iron arches, carried by steel beams and columns.

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## New Catalogs.

**There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9 x 12", 6" x 9" and 3½ x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.**

The E. W. Bliss Company, of Brooklyn, N. Y., has issued a pamphlet containing a number of views of the works. An introduction is included which gives a short sketch of the founding and development of the business. The pamphlet is standard size, 9x12 inches.

The C & C Electric Company, of New York, sends us bulletins Nos. 124, 125 and 126, which describe respectively, multipolar, ironclad and bipolar dynamos. The construction and method of operation of the various devices are gone into in detail. All of the bulletins are 5¼x8 inches.

The Lincoln Iron Works, Rutland, Vt., sends us Circular No. 82, in which are illustrated and described stone sawing machines. The catalog contains detailed accounts of the various points regarding the machines, and explains their mode of operation clearly. The catalog is standard size, 6x9 inches.

From the Mechanical Rubber Company, Chicago, we have received catalog and price lists of rubber specialties for mechanical purposes. A large variety of goods are described, including rubber belting, various kinds of packing, gaskets, hose, etc. The catalog is profusely illustrated, and is 5½x8⅜ inches.

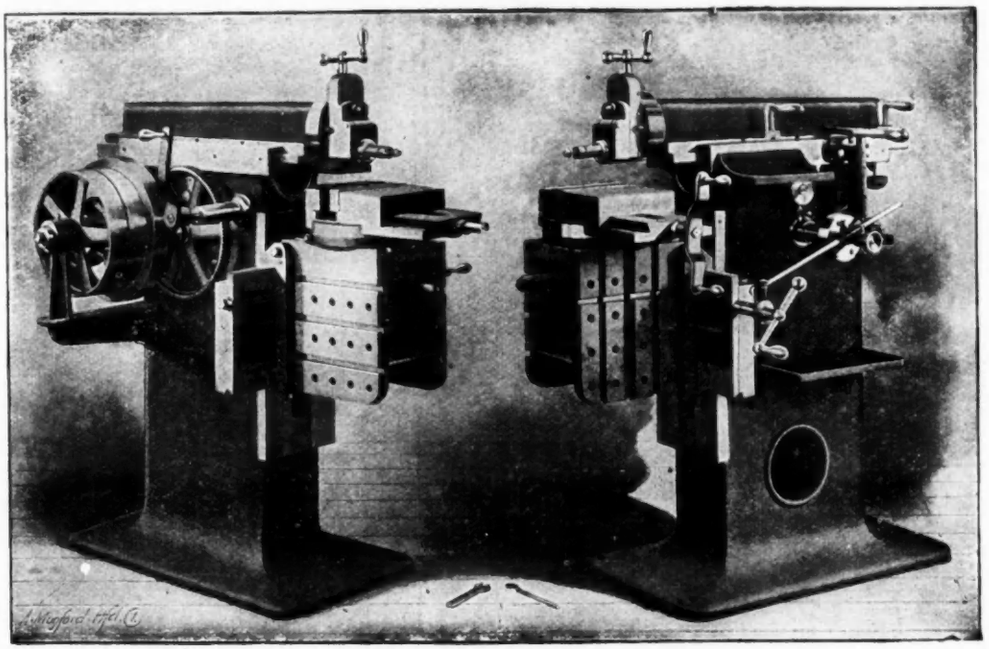
We have catalog of bolt threading and nut tapping machinery of the Detrick & Harvey Machine Company, of Baltimore, Md. The various machines are minutely described. The bolt threading machines are made to thread one, two or three bolts at a time. The catalog is nicely illustrated, and, in addition to tapping and threading machines, describes nut facing machines, bolt pointing machines. The catalog is 6x9¼.

From the Skinner Chuck Company, New Britain, Conn., we have received 1898 catalog and price list of lathe, drill and planer chucks. The catalog is fully illustrated and the construction and method of operations of the various chucks are gone into in detail. The lathe chucks shown are of varying sizes and patterns, with reversible and common jaws. The catalog contains a telegraph code for use in ordering tools, and is standard size, 6x9 inches.

From Powell & Colné, 11 Broadway, New York, we have received pamphlet containing reprint of a paper read at the Cincinnati Convention of the American Foundrymen's Association last June. The paper describes what is known as the Tropenas steel process. Facts concerning the history and development of this process are given. A number of illustrations of sample castings and results of a number of tests of the same are presented. The pamphlet is standard size, 6x9 inches.


# 15-inch Pillar Shaper.

A FRICTION driven machine, fitted with a positive locking device for friction, insuring a uniform length of stroke under a heavy cut. Stroke can be changed to any position with ram in motion; has quick return; and our micrometer adjustment makes possible the most minute variation in length of stroke, which can be constantly varied with machine in motion; an especially valuable feature in tool and die work and in planing to irregular lines.



## THE HENDEY MACHINE CO.,

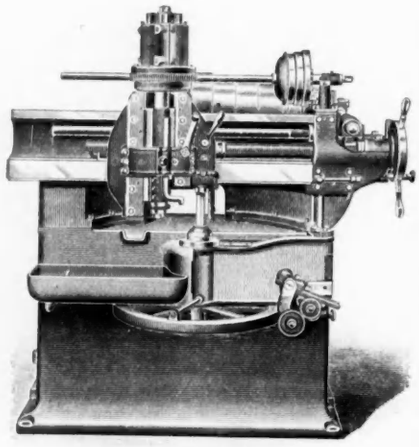
**Torrington, Conn.**

AGENTS FOR THE PACIFIC COAST:
PACIFIC TOOL AND SUPPLY CO., . . . San Francisco, Cal.
J. W. CREGAR, . . . . . Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
SCHUCHARDT & SCHUTTE, . . Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, . . . . . Paris, France.

# The Fellows Gear Shaper

is an automatic gear cutting machine, operating on an entirely new principle.
It produces gears, by a planing process, that run practically without noise.



The cutter used on this machine is a universal one; only one is required for each pitch.
It is a generating cutter, having its tooth form ground after it is hardened.


## Some Points on the Fellows Gear Shaper.

As explained and illustrated in these columns in the issue of December 9, 1897, the distinctive feature of this system of gear cutting is the fact that the gear tooth is generated by a planing cutter, instead of being formed by a milling cutter. This cutter is the keystone to the whole system. It is obvious that the perfection of cut gearing is more dependent upon the cutter than upon the machine operating it, and that, with the perfection now obtained in this class of machinery, any advance must be in the line of the cutter, rather than in the mechanical detail of the machine behind it. This advance has been made at one leap, by abandoning the formed milling cutter, with its attendant errors of hardening, etc., and substituting a planing cutter, having its tooth form ground theoretically correct after it is hardened. This tooth form is thus produced mechanically upon the hardened cutter, instead of by forming tools, upon the soft one. The generating surface of the emery wheel, upon which this cutter tooth is rolled, has a straight face, which can be kept true.

The method of using this cutter is as distinctive as the cutter itself. The machine operating it is called the gear shaper from the fact that the cutter has a reciprocating motion similar to that of a shaper. The cutter, passing back and forth over the face of the blank parallel to its axis, first planes its way into the blank to the required depth for the pitch to be cut. At this point the feed is changed to one slowly rotating the cutter and the blank in unison, precisely as if they were two gears in mesh. The combination of this reciprocating and rotating motion causes each tooth of the cutter to produce a recess in the blank, leaving a tooth that meshes perfectly with the cutter. Any two gears planed with this cutter will run together; that is to say, that one cutter produces any size of gear of its own pitch. This one feature alone is important, as it greatly reduces the investment in cutters.

The reciprocating motion of the cutter is produced by a crank and transmitted to the cutter slide through a rock shaft. The cutter is drawn, not pushed, through the work. By placing a support over the top of the work the cutting strains are all confined to one casting, instead of tending to force the machine apart. Means are produced for clearing the cutter from the work on the return stroke.

The method of holding the cutter arbor and work is unique. The arbor has an inverted taper—the reverse of the general practice—and is placed in the spindle from the under side. A face plate screwed to the arbor draws it into the spindle, making the whole practically one piece. The gear blanks are now clamped to the face plate, supporting them by the rim. This makes the stiffest combination possible.

The method of setting the cutter to the work permits the greatest accuracy. Center distances can be duplicated exactly.

Another strong point is that the cutter cannot be set "off the center." This is a very fruitful source of trouble with the milling cutter.

An interesting experiment with this machine is performed by placing a blank upon the work spindle, clamping very loosely, so that any side thrust of the cutter will cause the blank to turn upon the arbor. If the proper change gears are placed upon the machine, causing the arbor to have its required motion, the cutter will apparently produce a correct tooth, but it will be found at the completion that the blank has rotated slightly faster than the cutter. This proves that there is very little side thrust of the cutter.

Internal or annular gears can be cut by this system with the regular cutter. No attachments or changes whatever are required. This class of gearing has been but little used, as it has been very difficult to cut. It has the advantage of having less sliding action between the teeth than external gearing, and also that, for a given reduction of speed ratio, the train of gearing can be more compact. Now that these gears can be cut as easily and accurately as external gears, they are coming into more general use. This is particularly noticeable in motor carriage work.

While quality of work produced is the strong point of this system, the equally important feature of output has not been overlooked. The advantage over the rotary cutter is particularly noticeable in cutting steel. The cutter having a top rake, the chip is cut off, not scraped off. The chips curl up similar to those from a lathe tool. The section of this chip is wedge shaped, overlapping like shingles, the thin edge of each forming the finish of the tooth. Thus the finish is, within reasonable limits, independent of the feed. This and the fact that there are several teeth cutting at one time admits of relatively coarse feeds.

The whole scheme is so simple that, while the machine is entirely automatic from the start, it is free from all complicated mechanism.

If you are interested, the Fellows Gear Shaper Company, of Springfield, Vt., will consider it a pleasure to be permitted to give you any further information desired.


M. Koyemann, Dusseldorf, Germany.
Henry Kelley & Co., Manchester, Eng.
John Lang & Sons, Johnstone, Scotland.
White, Child & Beney, Vienna, Austria.
E. Hirsch & Co., Stockholm, Sweden.

## Modern Second-Hand Tools.

**At special low prices before removal.**

**LATHES.**
- 12 in. x 5 ft. F. E. Reed.
- 14 in. x 6 ft. Reed, Blaisdell, Flather.
- 16 in x 6 ft. P. & W., Blaisdell, Flather.
- 18 in. x 8 ft. Bradford, Flather.
- 20 in. x 10 ft. Putnam Machine Co's.
- 23 n. x 12 ft. New Haven.
- 24 in. x 22 ft. David W. Pond.
- 28 in. x 14 ft. David W. Pond.
- 32 in. x 18 ft. Fay & Scott.
- 40 in. x 16 ft. Fifield.
- 50 in x 14 ft. Fifield.

**PLANERS.**
- 40 in. x 12 ft. Fitchburg.
- 36 in. x 12 ft. Sellers, extra side head.
- 36 in. x 8 ft. Bement.
- 26 in. x 10 ft. Ferris & Miles.
- 24 in. x 6 ft. Powell.

**SHAPERS.**
- 24 in. Hendey Friction.
- 16 in. Standard Crank Motion.
- 15 in. Prentiss Friction.
- 12 in. Prentiss Crank.

Pratt & Whitney Nos. 1 and 2 wire feed screw machines.
Milling Machine, Bridgeport, plain extra heavy, weight 3,000 lbs.
Upright Miller, Bliss, large size.
Morton Keyseater, 24 in. stroke.
Fox Monitor Lathes, 16 in., American Tool Co's.
Upright Drills 20, 26 28 and 30 in.
Universal Radial Drill, 5 ft. arm.
Radial Drill, 5 ft. arm, latest pattern.
Boiler Bending Rolls, 14 ft. 2 in.
Bradley Hammer, 100 lb.

Send for complete list.

**J. J. McCABE,**
**14 Doy Street, NEW YORK.**

*What do you do with the oil*

*you use on your screw machines and turret lathes?*

*Throw it out back of the shop in the chips?*

*That's not the way to get rich.*

*You ought to use the oil over and over again. Wear it out.*

*The best way of reclaiming oil from chips, screws, bolts, nuts and other small work is by using a Roper Centrifugal Oil Separator.*

*The cost is small compared with the savings effected.*

*This separator is no new scheme; it's seventeen years old. Book free.*

*American Tool & Machine Co.,*

*Boston.*

*Founded 1845. Incorporated 1864.*

## SECOND-HAND MACHINERY.

**ENGINE LATHES.**
- 13 in. x 6 ft. Ames.
- 14 in. x 6 ft. Prentice.
- 16 in. x 6 ft. Ames.
- 18 in. x 12 ft. Bogart.
- 27 in. x 12 ft. Wood & Light.
- 16 in. x 8 ft. pattern maker's.

**SCREW MACHINES.**
- No. 2 Wire feed.
- No. 2 P. & W., plain.
- No. 2 1-2 P. & W., wire feed.
- No. 4 Windsor, plain.
- No. 4 Windsor, wire feed, auto.
- No. 2 Niles, heavy.

**PLANERS.**
- 16 in. x 16 in. x 4 ft.
- 20 in. x 20 in. x 5 ft.
- 24 in. x 24 in. x 4 ft
- 25 in. x 25 in. x 10 ft.
- 28 in. x 28 in. x 8 ft.
- 36 in. x 36 in. x 12 ft.
- 48 in. x 48 in. x 15 ft.
- 60 in. x 60 in. x 22 ft.
- 72 in. x 72 in. x 20 in., 3 heads.

**SHAPERS.**
- 9 in. Traveling head, Sellers.
- 13 in. Traveling head, Bement.
- 20 in. G. & E.

**DRILLS.**
- 6 spindle Quint.
- Pond suspension.
- 22 in. G. & E., geared.
- 24 in. Ames, geared.
- 32 in. G. & E., geared.
- 32 in. Harris, geared.
- Combined Drill and Slotter.
- 4 Spindle Ames.
- Bicycle frame drill.

**MILLERS.**
- Lincoln Type Miller, P. & W.
- Hand Miller, Ames.
- Special Cam Miller.
- Double-head Cam Miller, P. & W.

**MISCELLANEOUS.**
- 34 in. Lead Lapping Machine.
- No. 2 Water Tool Grinder.
- Centering Machine.
- 24 in. Gear Cutter.
- 36 in. Hand Gear Cutter.
- 48 in. x 12 ft. Hor. Boring and Drilling Machine.
- 12 in. Splitting Shear.
- Car mortiser and borer.

We have named above only our choicest tools.
Write us for anything you want.
Prices on application.

**THE NILES TOOL WORKS CO.**
*136-138 Liberty Street, New York City.*

## BARGAINS IN
**NEW AND SECOND-HAND MACHINERY.**

Lathes, from 12" to 48"; Planers, from 20" up to 60. 48", 54" and 60" Radial Drills; No. 2 Newton Milling Machine; No. 2 Screw Machine; Shapers, from 6" to 30", Boilermakers' Punches, Shears, Edge Planers, Rolls, Drills, Engines, Boilers, Pumps, and Dynamos.

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**IMPROVED 16" & 18" ENGINE LATHES**

**RAHN & MAYER**
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*Tools will be sold cheap before removal, in lots to suit.*

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- 5—No. 2 Brown & Sharpe Plain Milling Machines, with centers.
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- Brown & Sharpe No. 2 Universal Milling Machine.
- Cincinnati No. 2 Universal Milling Machine.
- No. 5 Lodge & Davis Universal Milling Machine.
- 4—No 5 Becker Millers, with rotary feed.

**LATHES.**
- 2—13 x 4 Pratt & Whitney, with raise and fall rest and taper attachment.
- 10 x 5 Pratt & Whitney Tool-Room Lathe, with all features.
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- 18—14 x 6 Bradford-Muller Engine Lathes.
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**DRILLS.**
- 20—Drills, assorted sizes.
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**SCREW MACHINES.**
- No. 6 Warner & Swasey, complete.
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- No. 2½ Garvin.
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**MISCELLANEOUS.**
- Lodge and Davis Cutter Grinder.
- Cincinnati Cutter Grinder.
- P-2 Ferracute Press.
- 18-in Flather Shaper, and numerous other mach.

**Send for complete list of small tools, machinery, etc.**

A large stock of Tubing, Tool Steel, Bicycle Machinery, etc., for sale. Machinery can be examined at Lafayette until sold or until Nov. 25. Address,

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IN EXCELLENT CONDITION.

**LATHES.**
- 50 in. x 20 ft. Fifield.
- 48 in. x 20 ft Sellers.
- 38 in. x 20 ft. Davis & Egan.
- 28 in. x 27 ft. Fifield.
- 27 in. x 10 ft. Davis & Egan.
- 24 in. x 20 ft. Fifield.
- 24 in. x 10 ft. Scott.
- 20 in. x 12 ft. Porter.
- 18 in. x 8 ft. Blaisdell.
- 16 in. x 6 ft. Reed.
- 15 in. x 6 ft. Porter.
- 14 in. x 6 ft. Davis & Egan.
- 12 in. x 5 ft. Silk.
- 10 in. x 4 ft. Frasse.

**MISCELLANEOUS.**
- 26 in. Davis & Egan Shaper.
- 17 in. x 17 in. x 4 ft. Putnam Planer.
- 30 in. x 30 in. x 6 ft. Putnam Planer.
- 30 in. x 30 in. x 8 ft. Star Planer.
- 36 in. x 36 in. x 12 ft. Davis & Egan Planer, with 2 heads.
- Hand Miller, Garvin.
- Universal Miller, Kempsmith.
- Lincoln Miller, Pratt & Whitney.
- 12 in. x 5 ft. Turret Lathe.
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- Oil Separator, Davis & Egan make.
- 8X Jones & Lamson screw mch.
- 50 in. Nixes Pulley Lathe.
- 40 in. B. G., P. F. Drill, Lodge & Davis.
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- No. 4 Power Press, R. & K.

Also full line latest improved new machine tools.

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- 89 x 15½ Lincoln, C. R.
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- 40 in. Pulley Lathe.
- 38-50 x 15 Gage, C. R. & P. C. F.
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- 30 x 23 New Haven, C. R. & P. C. F.
- 29 x 18 Ames.
- 26 x 8 Pond, C. R & P. C. F.
- 24 x 10 E. A. Betts, C. rest.
- 21 x 12 Wright, R. & F., 2 chucks.
- 20 x 12 Pond, C. R. & P. C. F.
- 19 x 8 Lodge & Barker, C. R. & P. C. F.
- 17 x 8 Putnam, R. & F. and P. C. F.
- 16 x 7 Bogert, R. & F.
- 15 x 6 Flather, P. C. F. and P. G.
- 15 x 6 Reed, P. G. rest.
- 14 x 7 Bogert, R. & F.
- 14 x 6 Putnam, R. & F. rest.
- 14 x 6 Prentice Brothers, R. & F.
- 13 x 5 Ames, R. & F. and chuck.
- 12 x 5 Star Plain Gib and P. C. F.
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- 15 x 5½ Amer. T. & Mach. Co., sq. arbor, Fox, B. G., 2 chucks and slide rest.

**DRILLS.**
- 48 in. Betts Radial Drill.
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- 60 in. Hilles & Jones, post.
- 34 in. Bickford, sliding head.
- 26 in. New Haven, B. G.
- 26 in. Prentice Brothers, B. G. & P. F.
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- 20 in. Prentice Brothers, W. & F. with chuck, fine.
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- No. 3 3 Spindle Garvin Gang.
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- 3 Spindle 22 in. Barnes Drill.
- 3 Spindle Woodward & Rogers, sensitive, fine.
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- 1 Spindle, sensitive, with chuck.
- 4 4 Spindle Slates, sensitive special.
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- Heavy Double Housing Waterbury Press, wgt 32 tons
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- No. 2 Brown & Sharpe Universal Grinder.
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- 50 in. Williams & Rich Gear Cutter.
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- 70 x 16 Willets Horizontal Boring Machine.
- 40 x 13 Willets Horizontal Boring Machine.
- 1 in. Putnam Bolt Cutter, fine.
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- No. 2 Merriman.

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Suppose you were in a country where it occasionally snows but never freezes and wanted to explain the nature of ice to the natives. They might have an idea that a "soaker" snowball contained all the qualities of good, pure ice, and you might talk until doomsday without convincing them to the contrary. But if you could put into their hands some crystal, pure ice their eyes would be opened at once to the difference.

There may be hundreds who read this who have an idea that because they are familiar with ordinary plumbago or blacklead that they understand the qualities of a pure flake graphite when ground to a fine degree of pulverization. To such people a sample of

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will be a revelation. We want to send you a sample of this, for it is quite new and but little known, and absolutely without an equal for lubricating the cylinders of gas engines, air brake pistons and cylinders, and all close and rapid running bearings—in fact, when mixed with any oil or grease it simply does wonders. Sample is sent free of charge.

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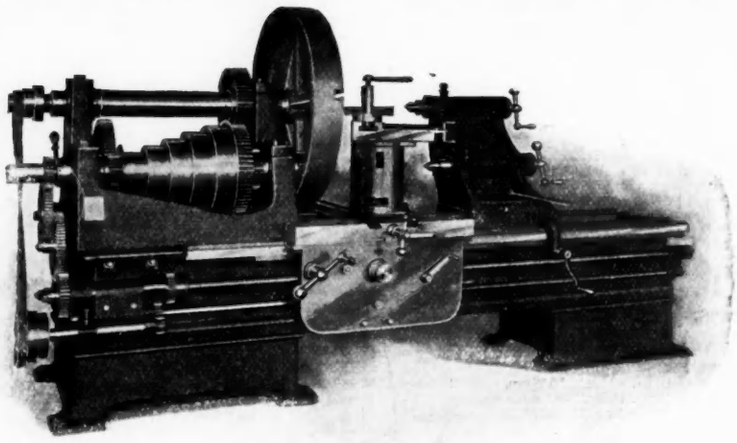

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*Being two lathes standing in the same place on the floor, one a 26-inch swing lathe for light work, the other a 44-inch swing for heavier work. Has a wide range of speeds and feeds. Hollow spindle with 2⅛ in. hole. Just exactly the right kind of a lathe to have in a shop. Fuller particulars for the asking.*

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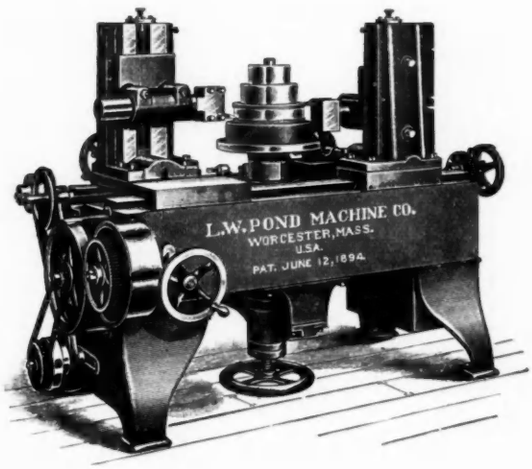


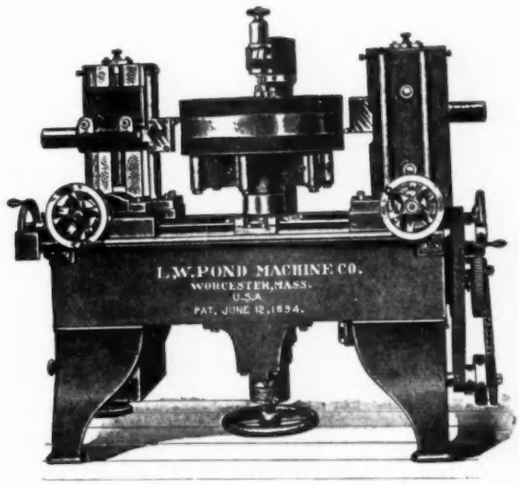


For turning all kinds of Arm, Cone and Webb Pulleys.

A machine that takes up but a small amount of shop room, and does a large amount of work in a small space of time, thereby saving time, money and, what is very valuable in all plants, shop room.

These machines are very powerfully constructed, being double geared, with large bearings, the main spindle being 9 inches in diameter, and the tool holders being made from steel forgings, finishing 3 inches in diameter, with bearings in saddles 9 inches in length.

These machines have power vertical feed on both heads, and power cross feed on one head.

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There can be from two to three times the amount of work turned out in a given time on one of these machines than can be done on an ordinary lathe of the same swing.

For further particulars and prices write the

## L. W. POND MACHINE CO.,

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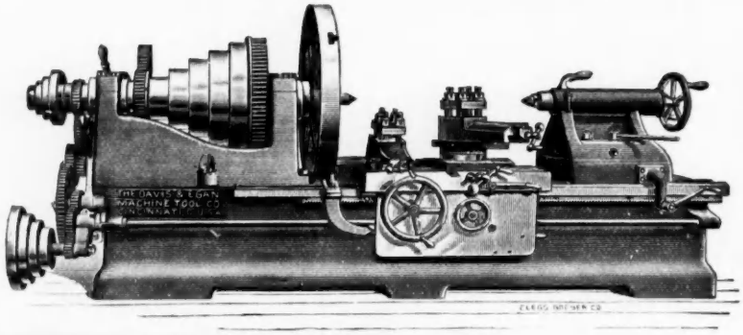
## TOOL WORKS CO.

**Successors to THE DAVIS & EGAN MACHINE TOOL CO.**



**We build 20 sizes of Engine Lathes, also Planers up to 60 in. Boring Mills, 5, 6 and 8 ft. Radial Drills, Milling Machines, Screw Machines, Upright Drills, Bolt Cutters, Monitor and Turret Lathes, Pulley Lathes, Punches and Shears, Etc.**

**OUR 60-INCH STANDARD LATHE** swings 62 inches over the bed, measures 30 inches between V's, has 6-step driving cone powerfully geared into face plate, double apron, etc.

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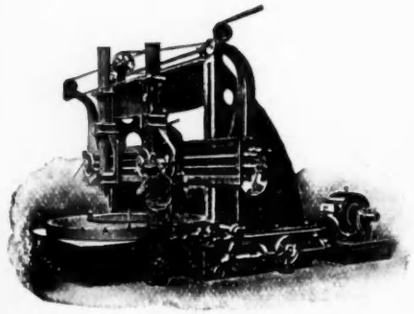
# Westinghouse



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of machinery is the most economical method. Let us tell you why.

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Didn't have room enough to expand there.
We've got it now.

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That's where we live now.
The number is 218 William Street—218.

The best way to get there is to go thro' the entrance to the Brooklyn Bridge—opposite New York City Hall—cross the four tracks of the electric juggernauts, turn to the right down the stairs marked "To William Street"; at the foot of the stairs turn to the left and pass under the bridge; at your right, just as you pass from under the bridge, and right next to it, you'll note a building whose upper stories are in the clouds. You have arrived at it; this is where we live; this is 218 William Street, New York.

The elevator is not so rapid as to cause you any alarm, but it will bring you up.

When you have gone up in the elevator as far as it goes you have arrived at the domain of the American Machinist.

You'll never be sorry for coming; we'll treat you nicely. Maybe we'll find an extra cigar in the box.

Anyway, we've got something up here in the top of this high building that's mighty interesting to most people, and we're somewhat anxious that you should see it.

Remember the number is 218 William Street, New York; that the latch string is out from 9 A. M. to 5 P. M. every day, and that we shall be pleased to see you.

American Machinist, 218 William St., New York City.

## The trouble is, we haven't work enough.

We want more.

We're well equipped in a modern way, and have been building nothing but the best of work.

Such work as the "Linotype" Machine—invented by Mr. Mergenthaler—and all sorts of automatic machinery and special tools.

Our shop was built to handle the best of work, and our workmen have all been trained in the same direction.

We'd like contract work on typewriters, cash registers, composing machines or kindred articles, where intelligent mechanical skill is necessary.

We are in a way to quote some very attractive prices on contract work, and quality will be all you can desire.

We'd rather have large contracts than small ones. We can handle the large ones without any trouble. That's what the shop was designed for. But we're not turning the small ones away.

Ott. Mergenthaler & Co.,

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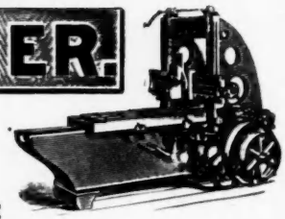

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**Cincinnati, Ohio,**
Manufacture Planers as an exclusive specialty.
Planers only! Nothing but Planers!!

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*NOTE.*—An important feature of our **MODERN LABOR-SAVING MACHINE TOOLS** is the convenient grouping of all of the operating levers and handles, thereby permitting the attendant to make necessary changes with rapidity and ease. This is one of the little details of construction which conduce not a little to the large capacity for work of our machine tools, as well as to the comfort of the operatives.

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knows that the maximum productive capacity of an engineering establishment or of a manufacturing plant working metals can be realized only through the use of the most durable and efficient cutting tools, but all of them do not appreciate the service which "Constant Angle" Twist Drills will render in accomplishing this result. Send for catalogue to

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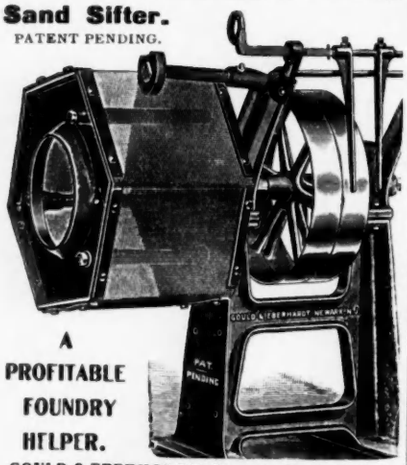
PATENT PENDING.

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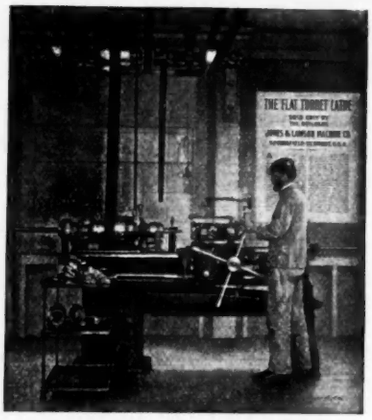


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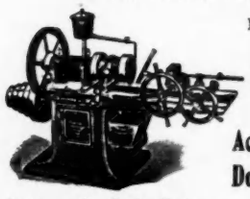

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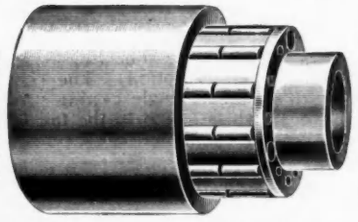

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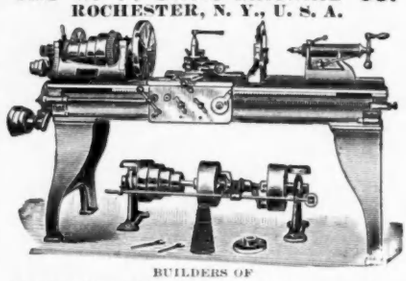

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